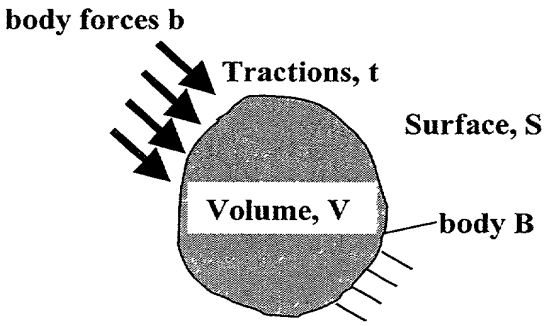


Fig. 1

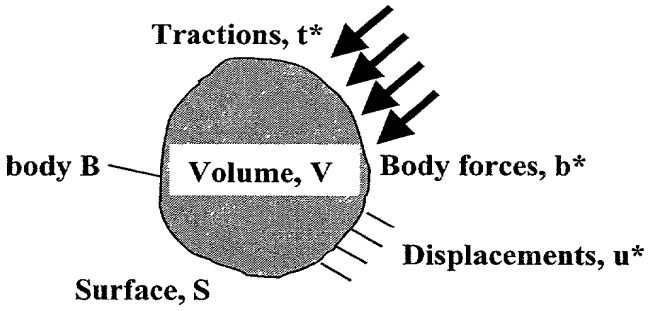


Fig. 2

TITLE: SYSTEM AND METHOD FOR STRESS AND STABILITY RELATED MEASUREMENTS IN BOREHOLES

INVENTORS: Michael J. Economides, Wolfgang F. J. Deeg, Peter Valkó, Michael Nikolaou, and Sathish Sankaran

ATTY DKT NO: H053451.0037US0

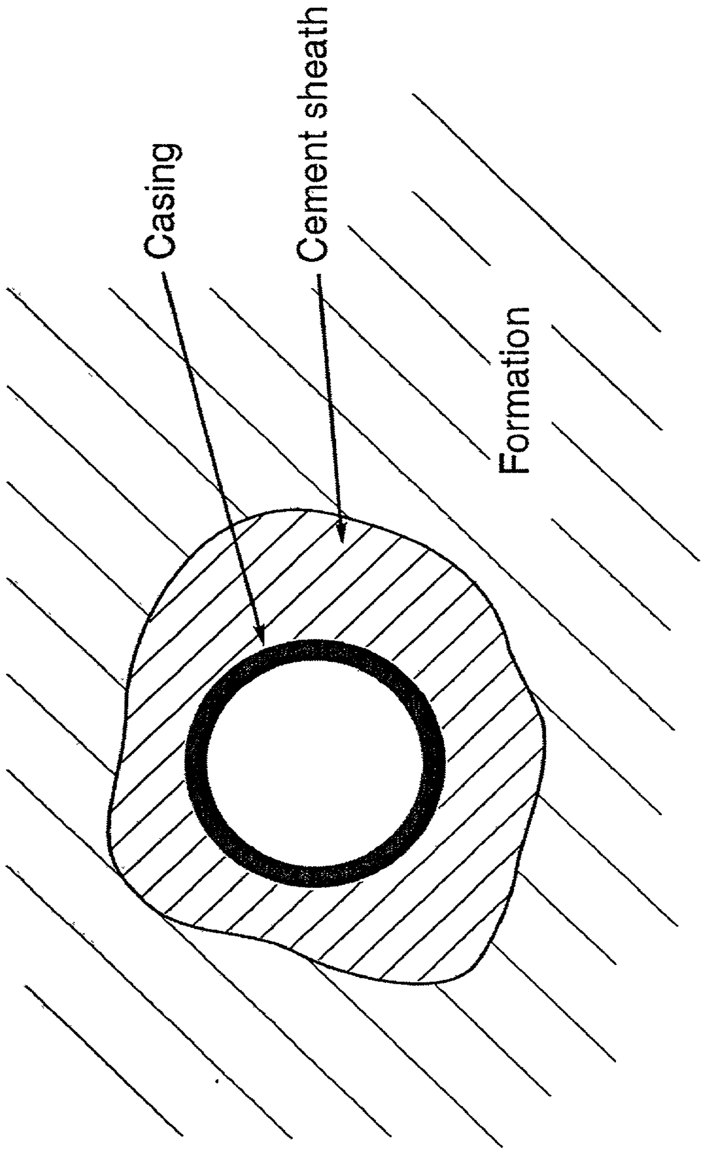


Fig. 3a

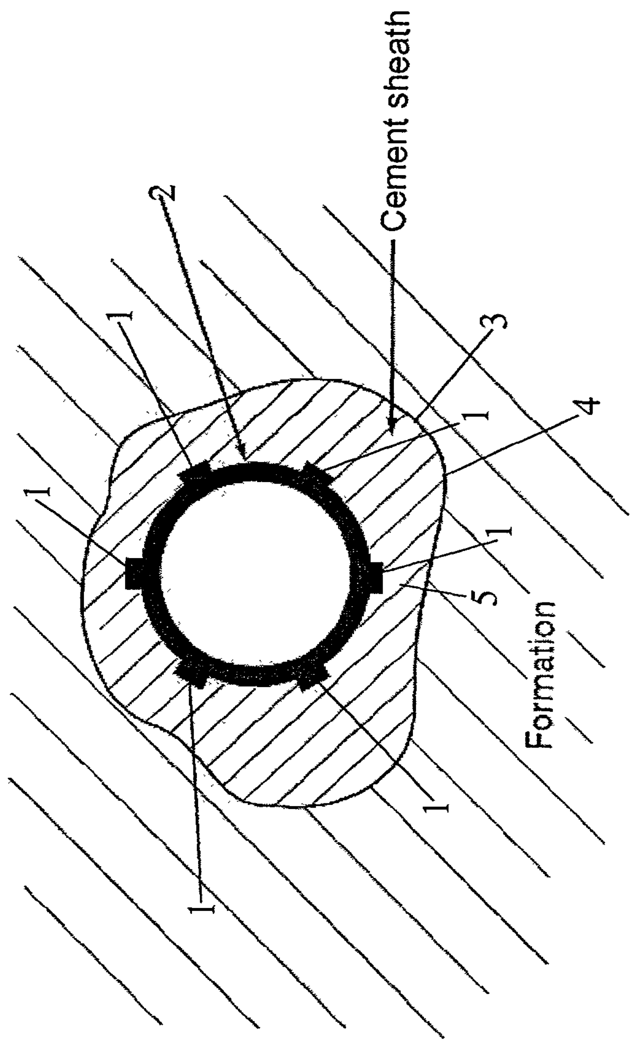


Fig. 3b

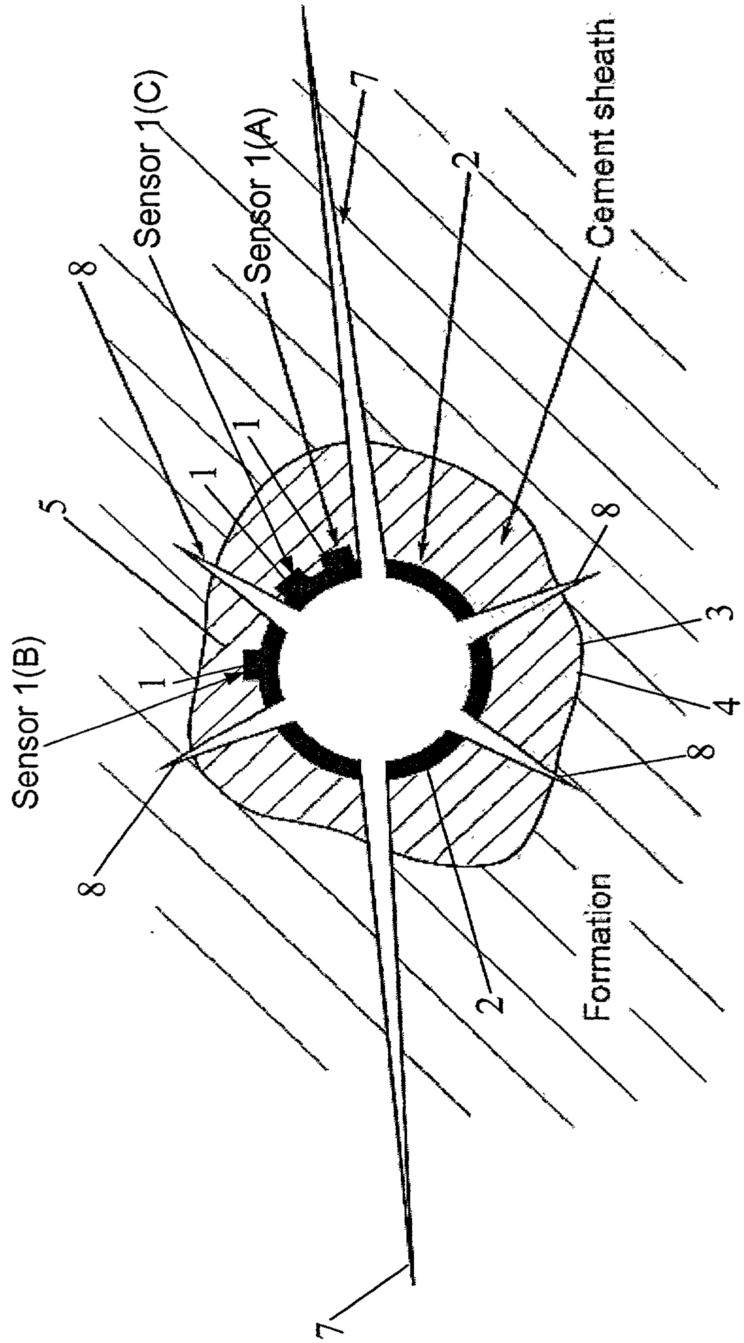

Sensor 1(C)
Sensor 1(A)
Sensor 1(B)
Cement sheath
Formation
1
2
3
4
5
7
8

Fig. 4

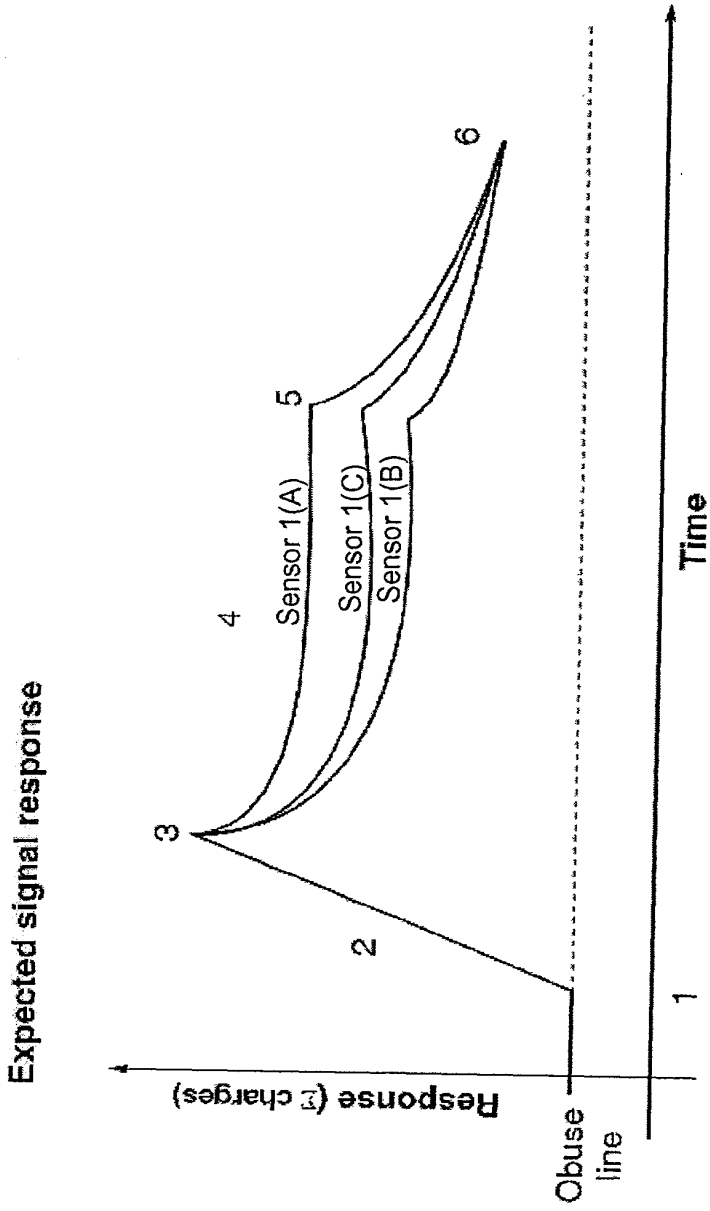

Expected signal response
Response (E charges)
Time
Obuse line
1
2
3
4
5
6
Sensor 1(A)
Sensor 1(C)
Sensor 1(B)

Fig. 5

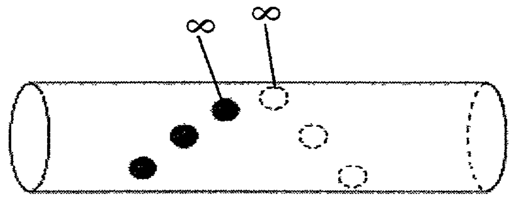


Fig. 6b

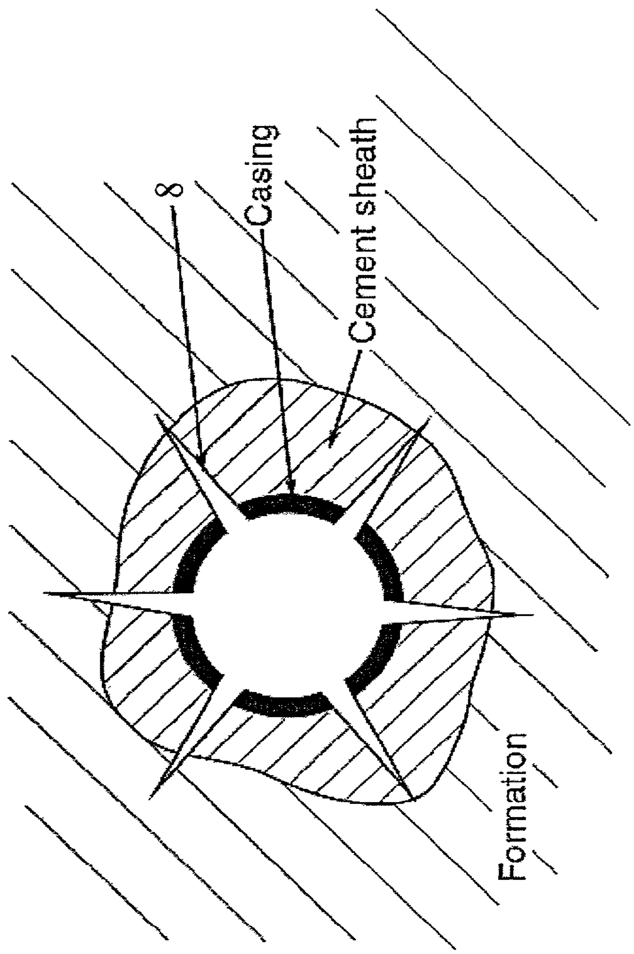
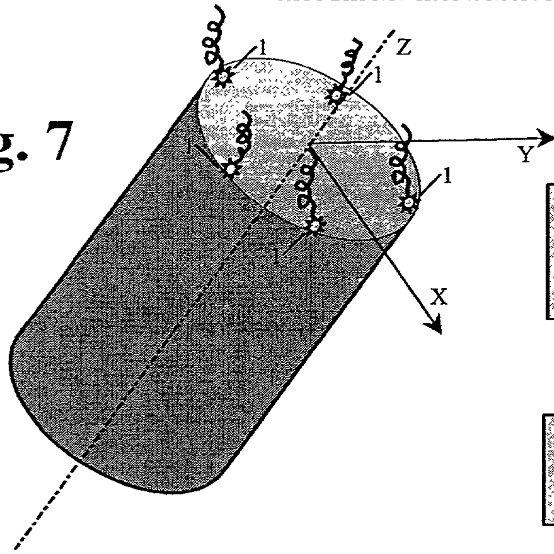


Fig. 6a

TITLE: SYSTEM AND METHOD FOR STRESS AND STABILITY RELATED MEASUREMENTS IN BOREHOLES
INVENTORS: Michael J. Economides, Wolfgang F. J. Deeg, Peter Valkó, Michael Nikolaou, and Sathish Sankaran
ATTY DKT NO: H053451.0037US0

Fig. 7



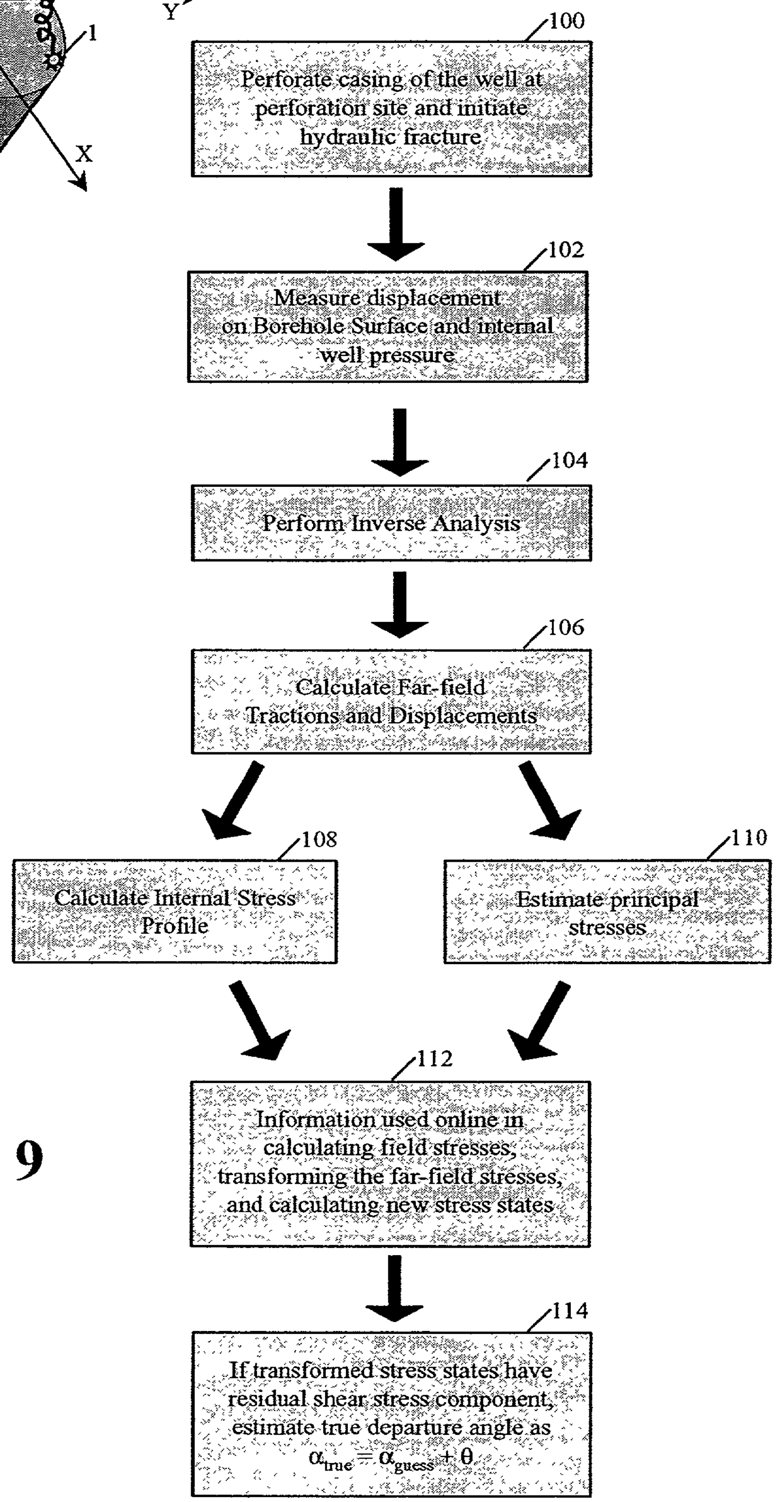


Fig. 9

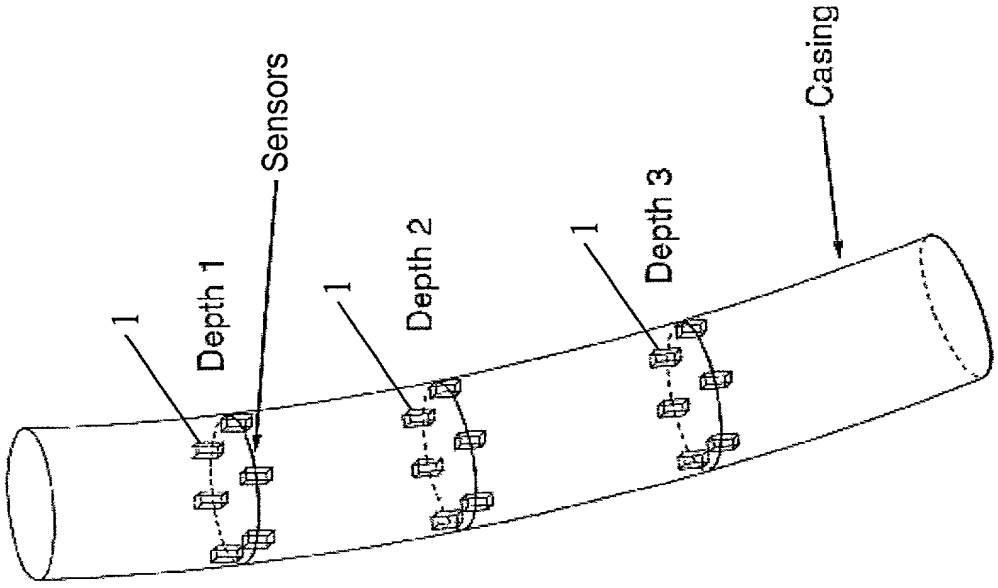
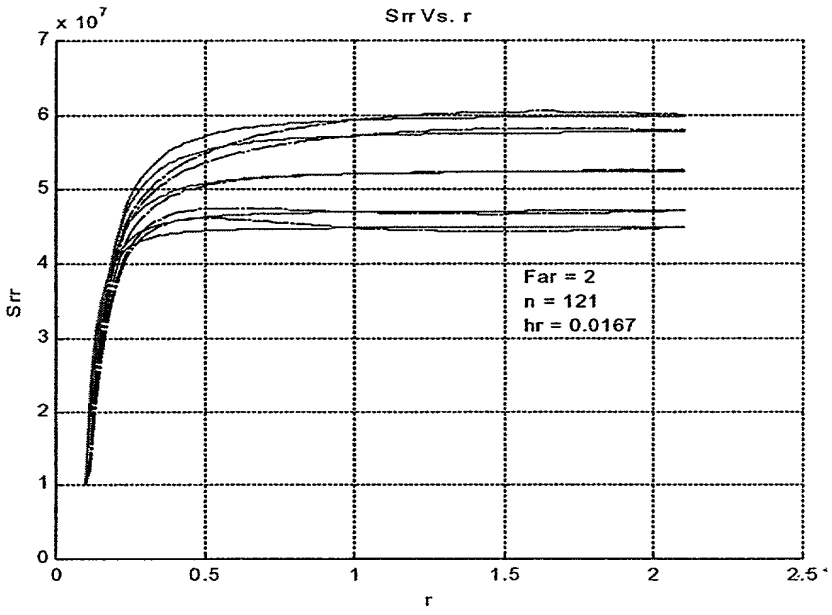


Fig. 8

Fig. 10 Finite difference model: Radial stresses (uniform grid size)



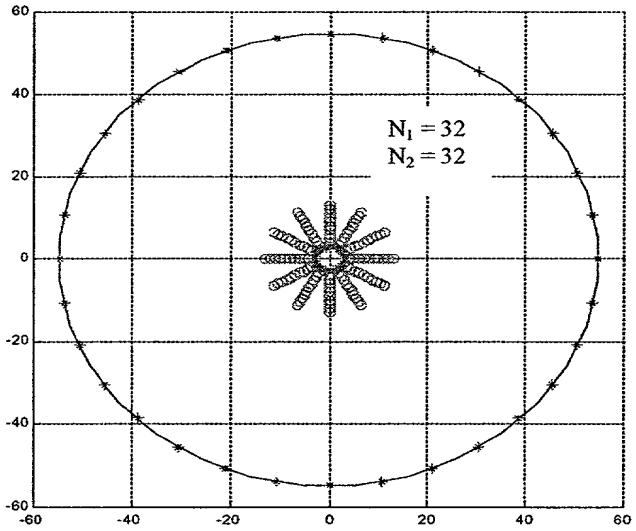


Fig. 11 Boundary elements for inclined well (without fracture)

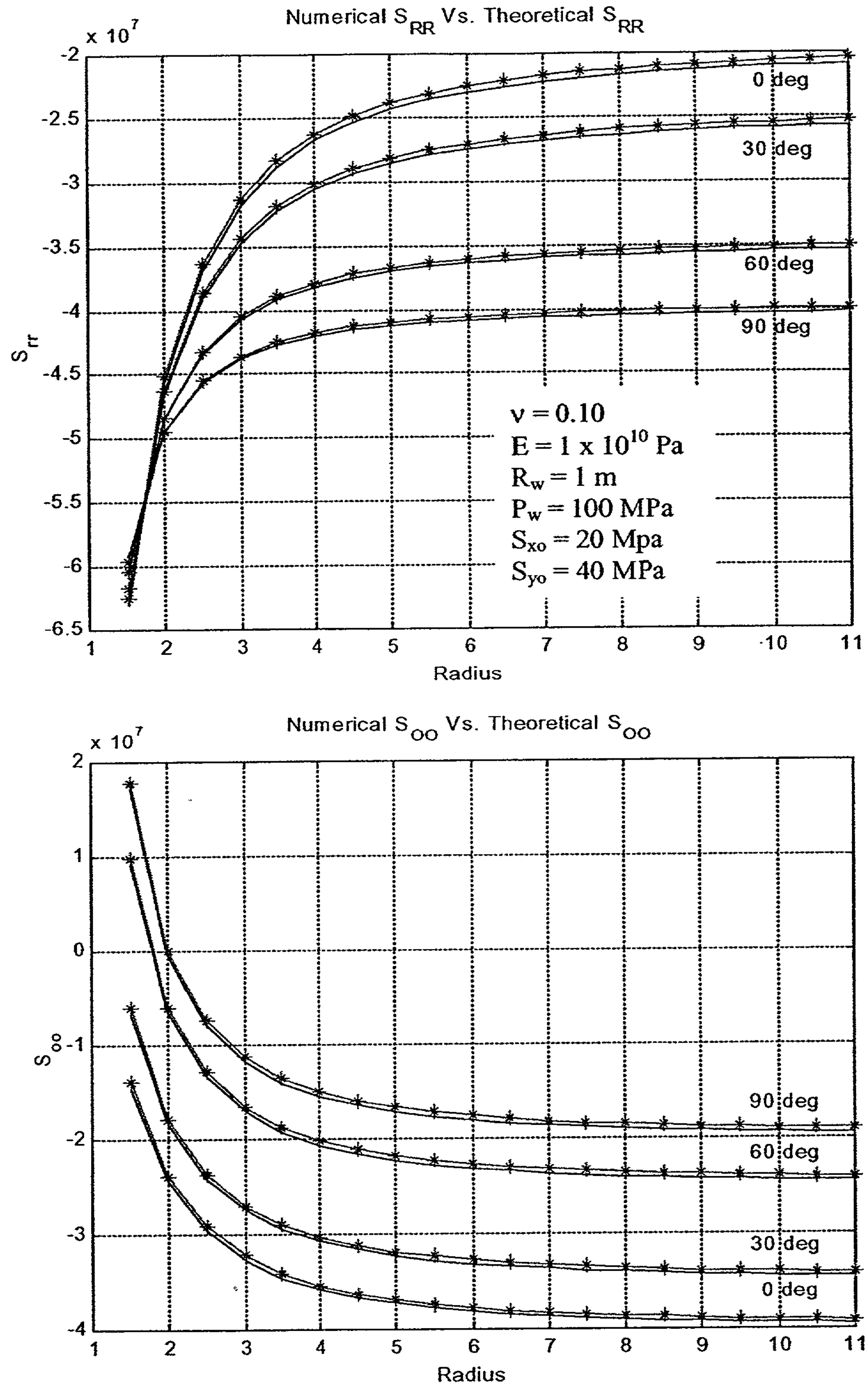


Fig. 12 Boundary Element model for inclined well: Internal stresses

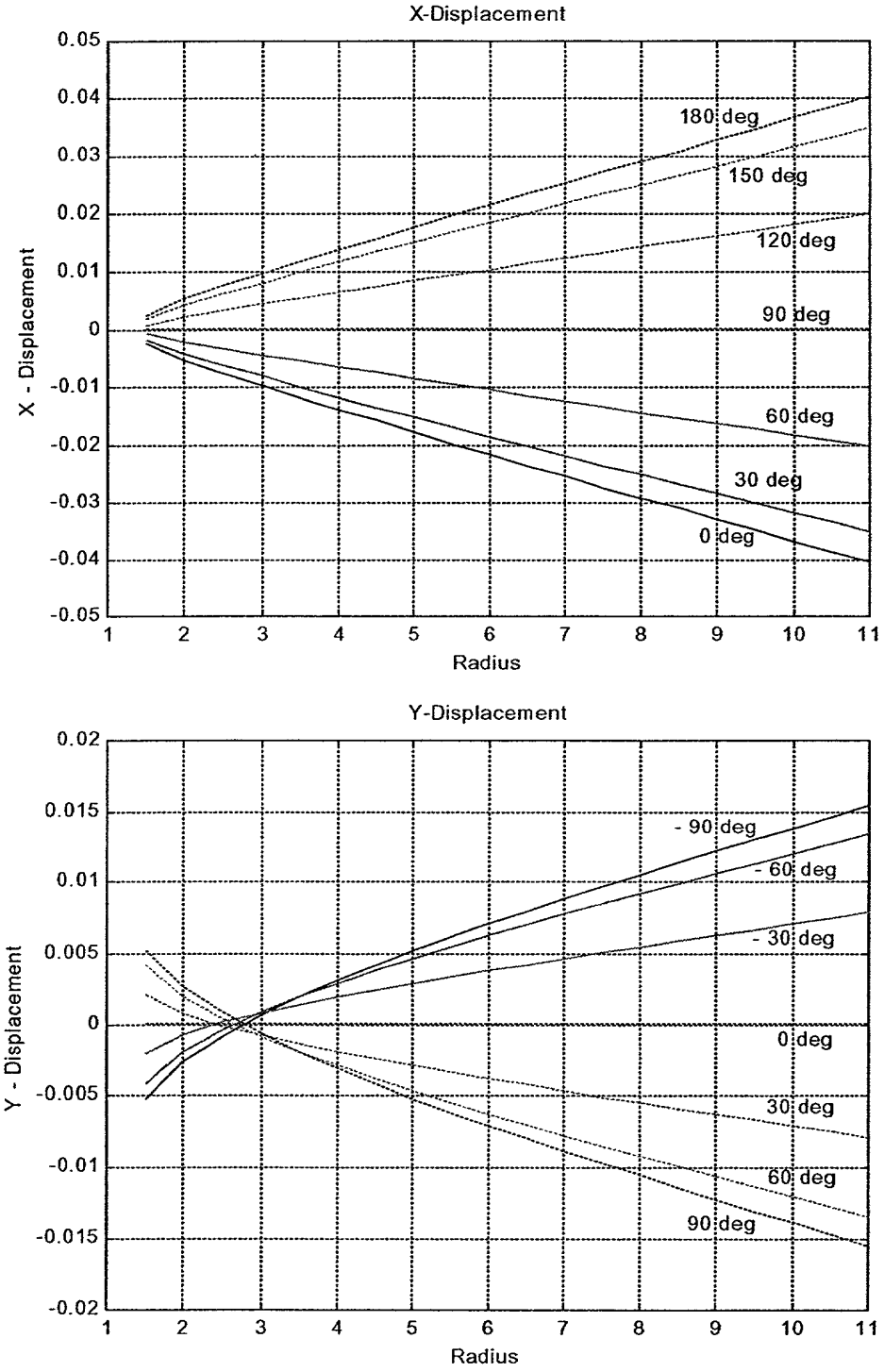
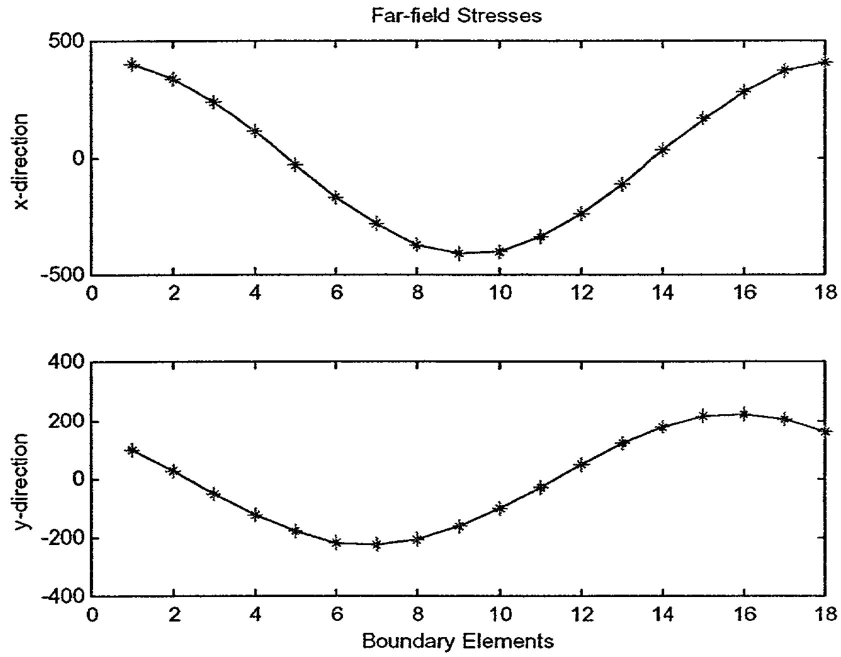


Fig. 13 Boundary Element model for inclined well: Internal displacements

Fig. 14 Far-field boundary solution for inclined well: Far-field stresses



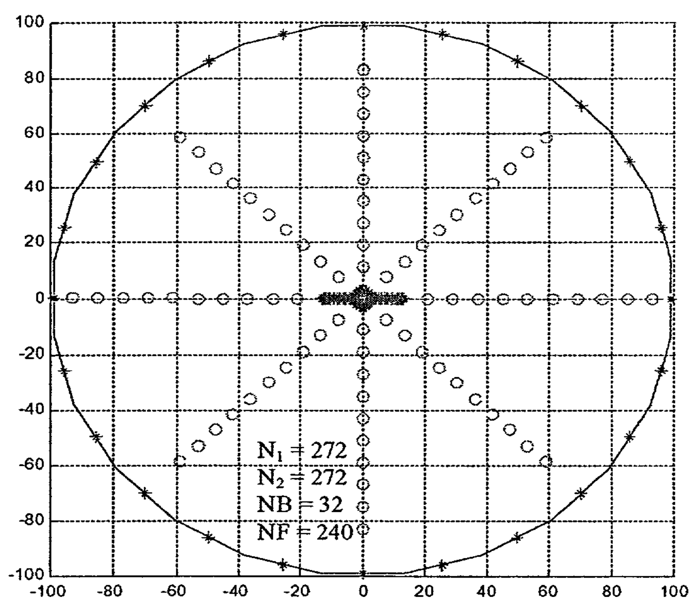


Fig. 15 Boundary elements for vertical well (with fracture)

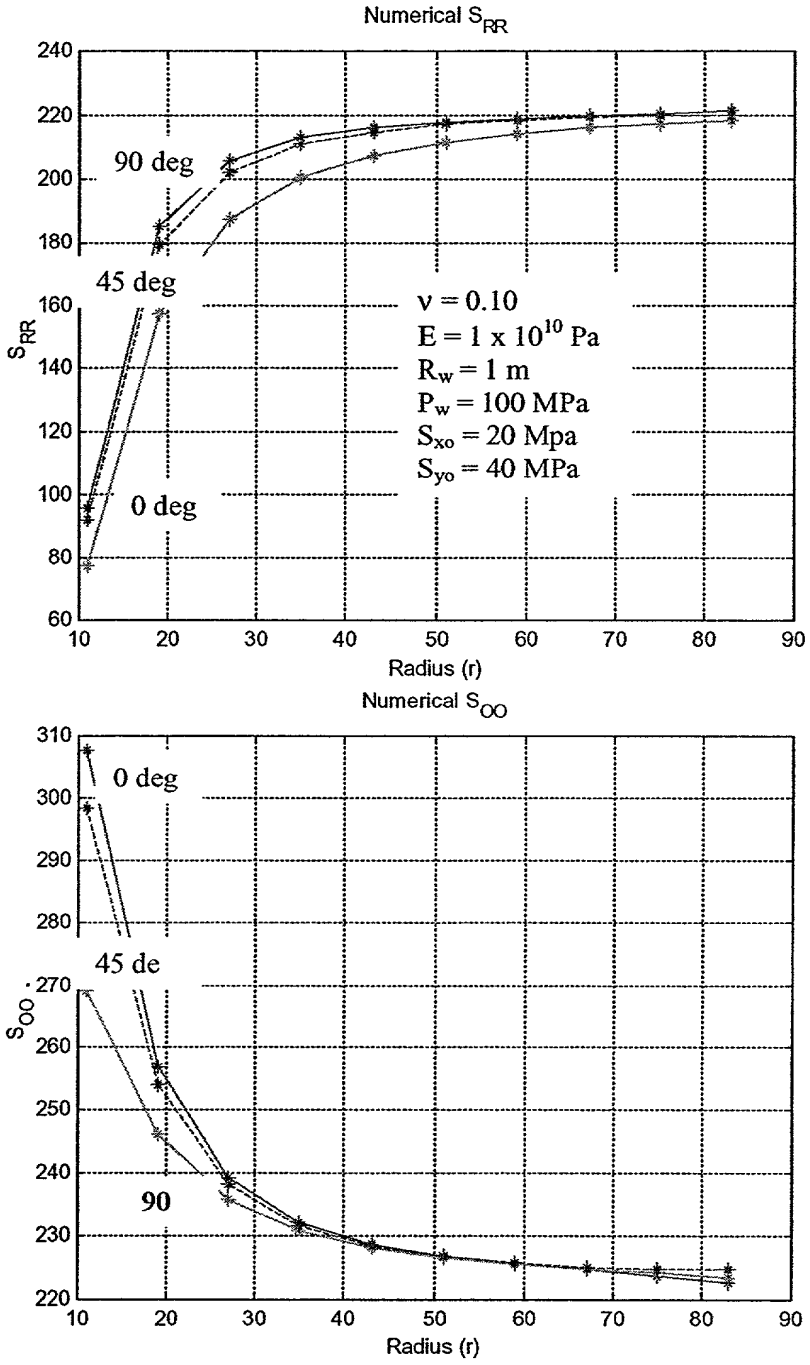


Fig. 16 Boundary Element model for vertical well with fracture: Internal stresses

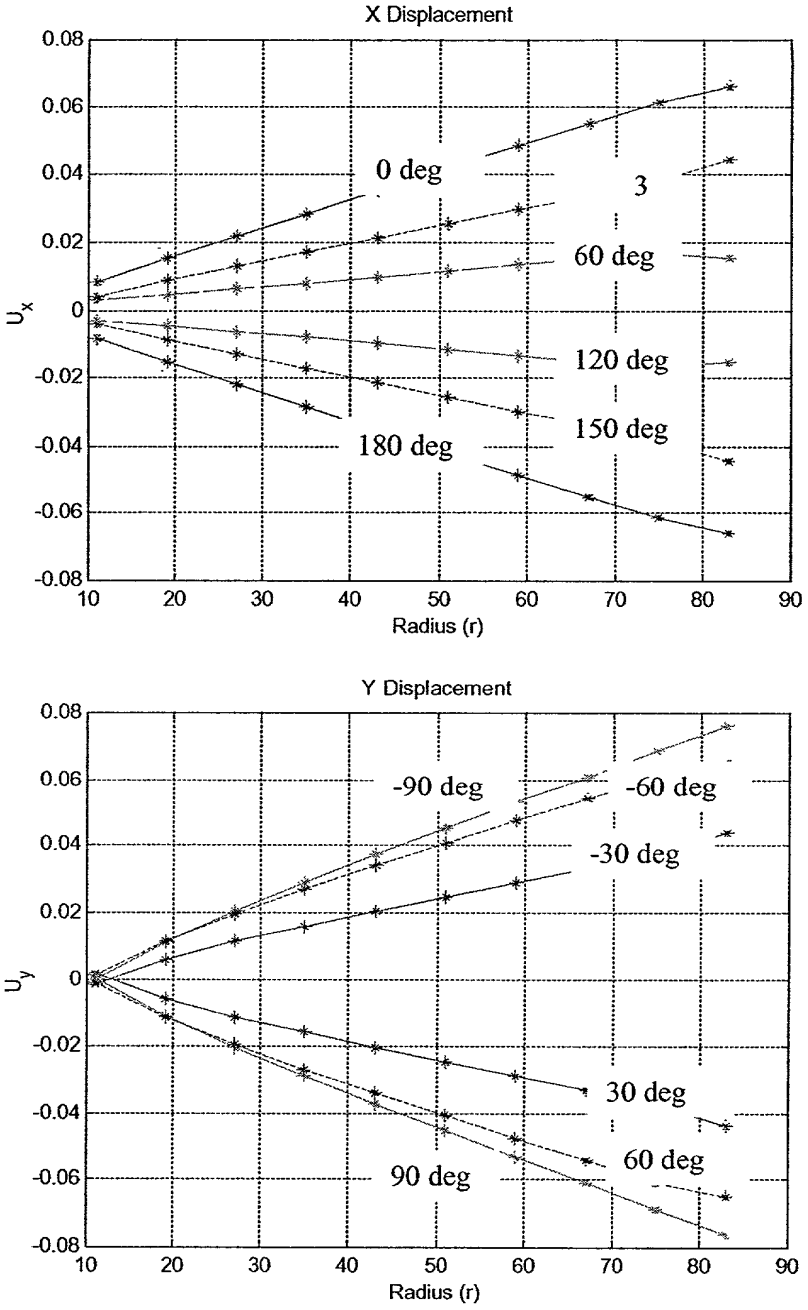


Fig. 17 Boundary Element model for vertical well with fracture: Internal displacements

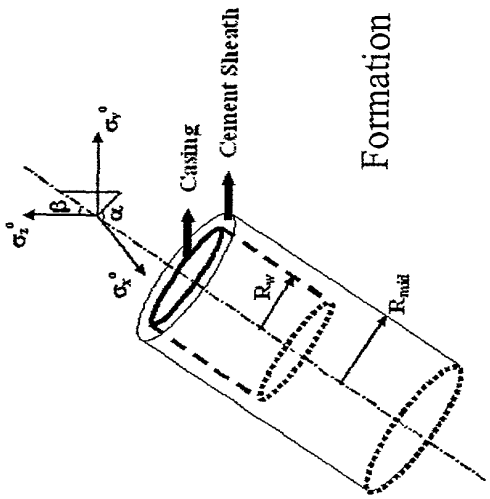


Fig. 17a

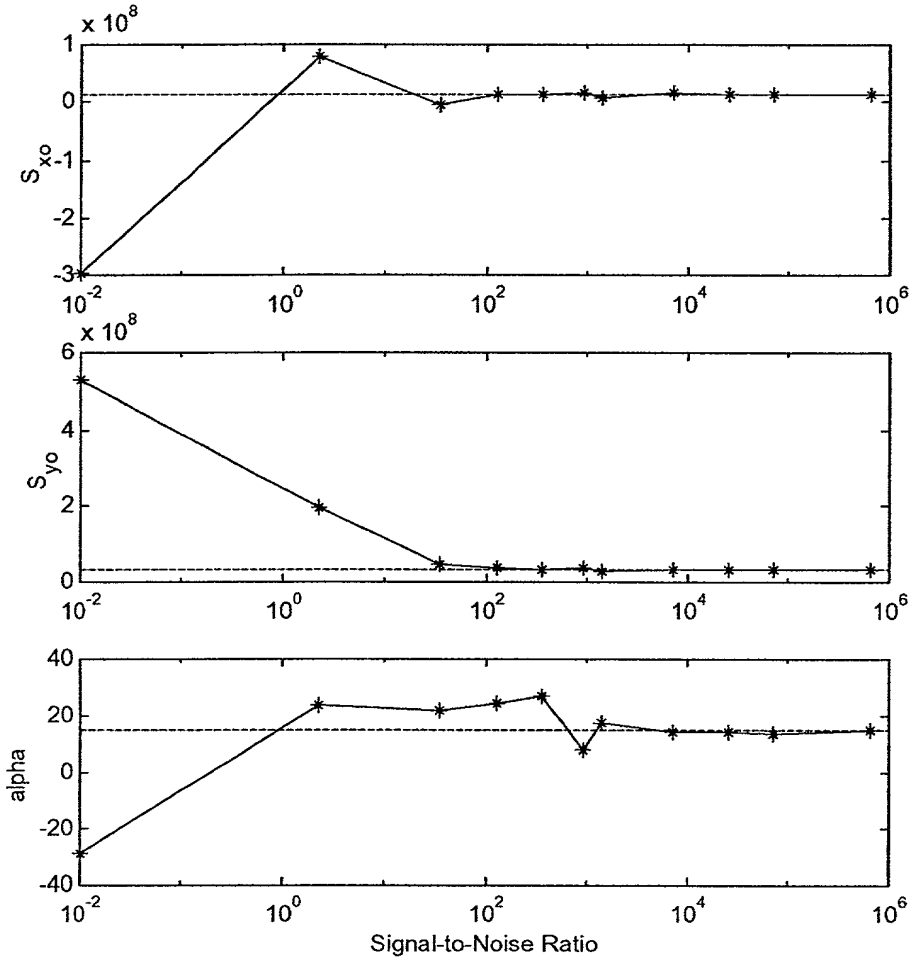


Fig. 18 Effect of noise on estimated parameters

Table I Simulation parameters

Parameter	Value
ν_1	0.10
ν_2	0.25
E_1	1.0×10^{10} Pa
E_2	2.0×10^{10} Pa
R_w	1 m
R_{mid}	2 m

Fig. 19A

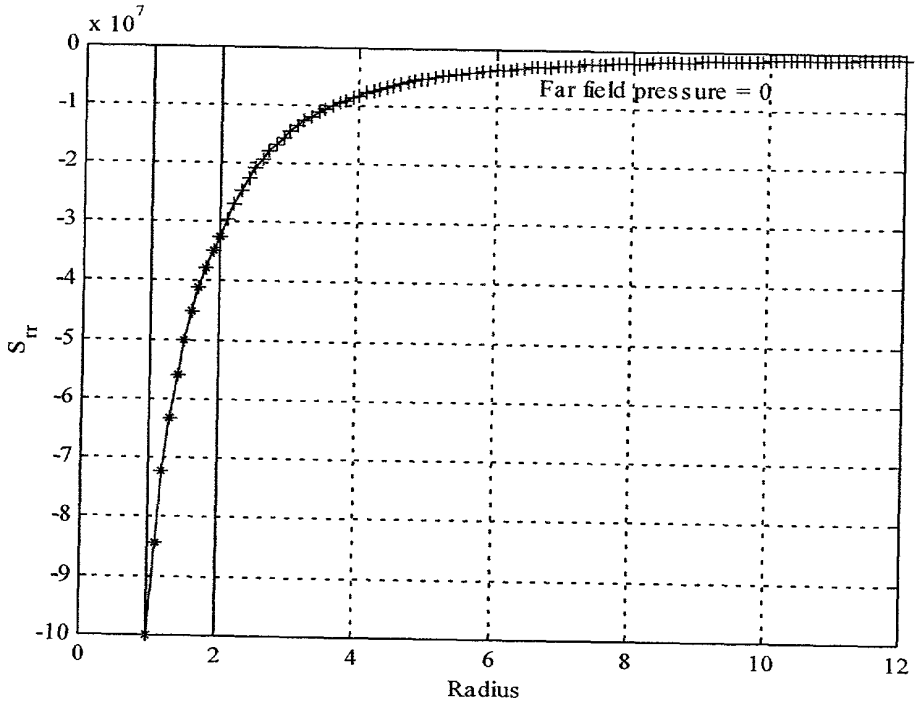


Fig. 19B Radial stress profile for one-dimensional problem

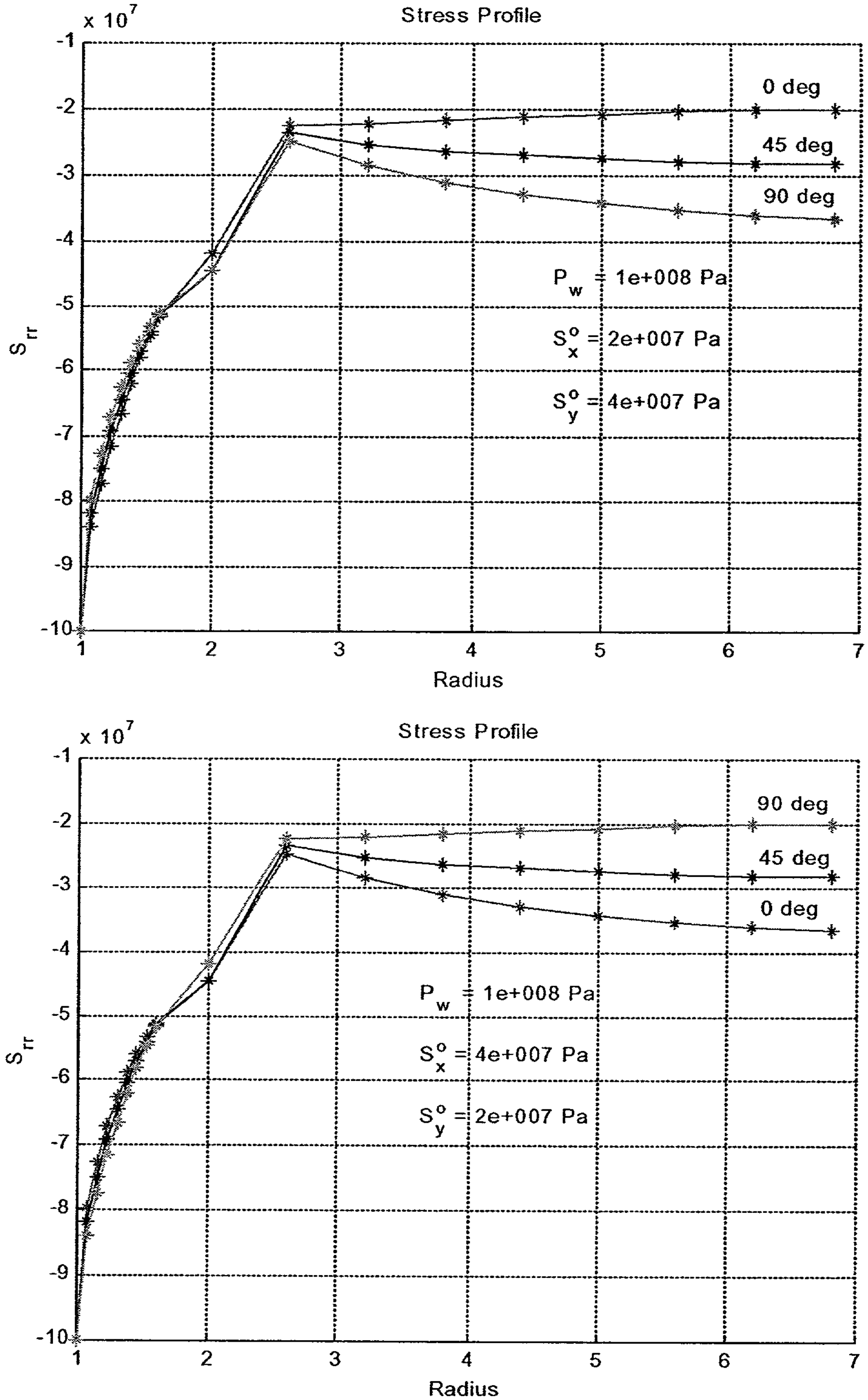


Fig. 20 Multiple zone model: Asymmetric loading

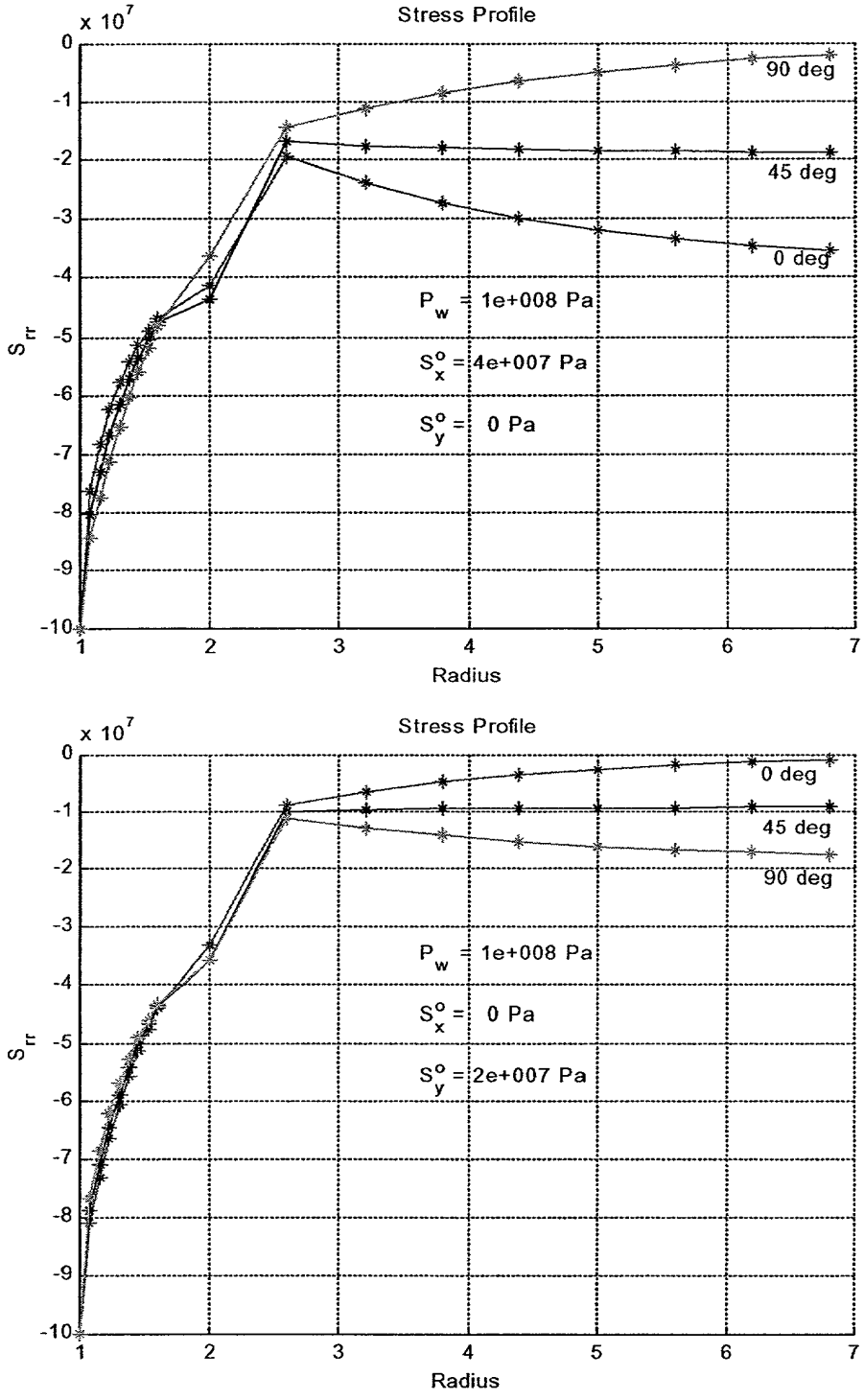


Fig. 21 Multiple zone model: uniaxial loading

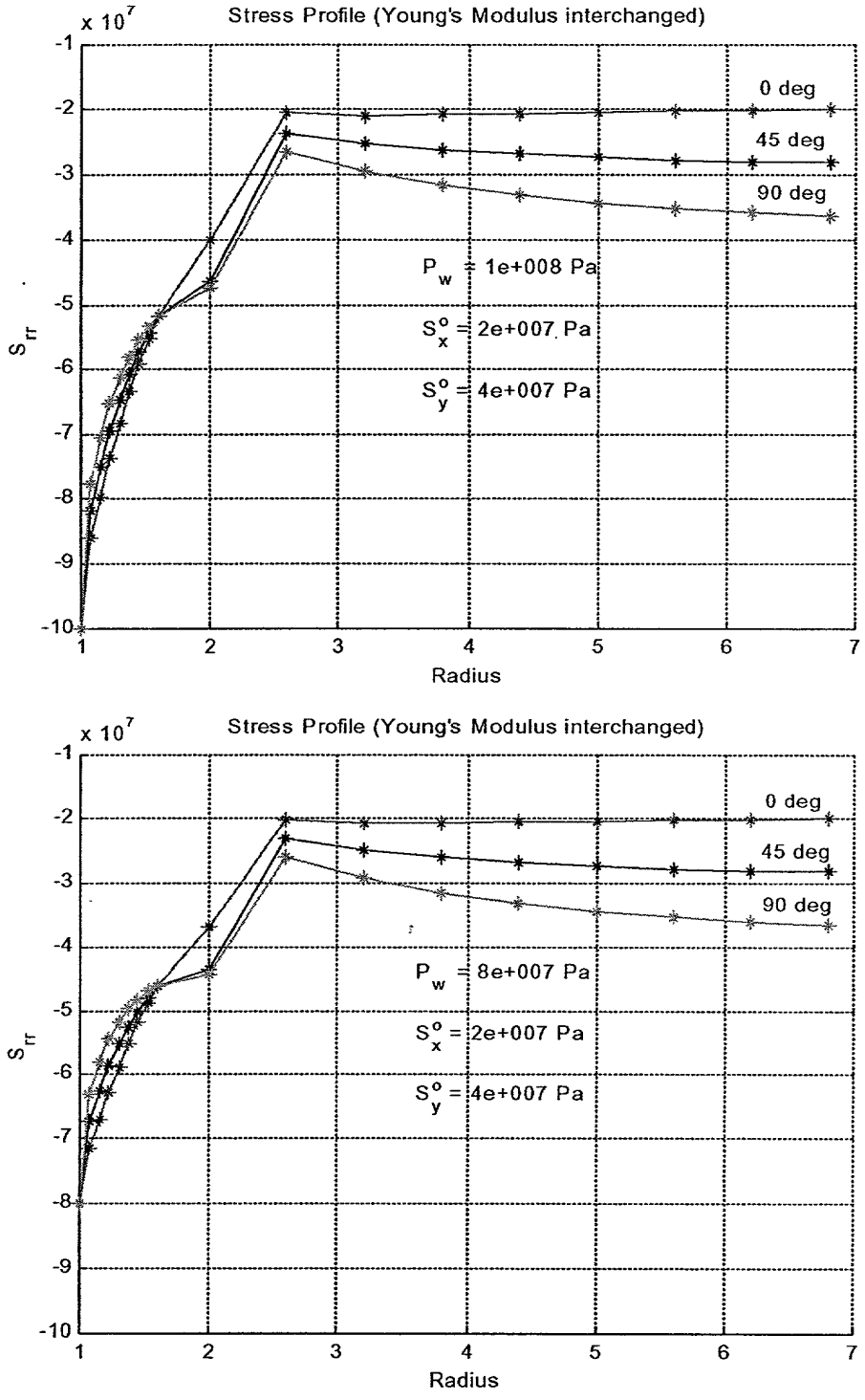


Fig. 22 Multiple zone model: Effect of Young's modulus

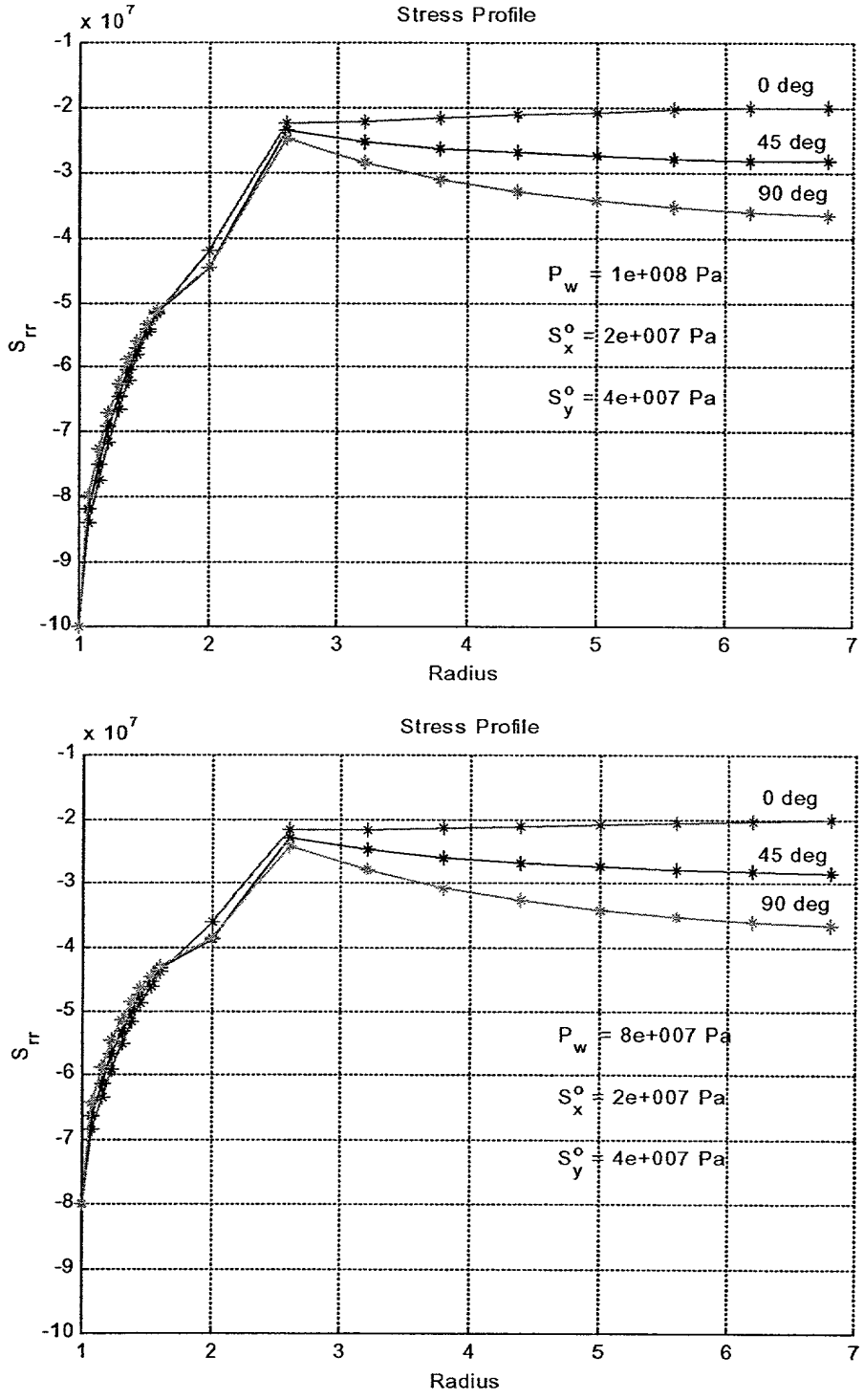


Fig. 23a Multiple zone model: Effect of internal pressure

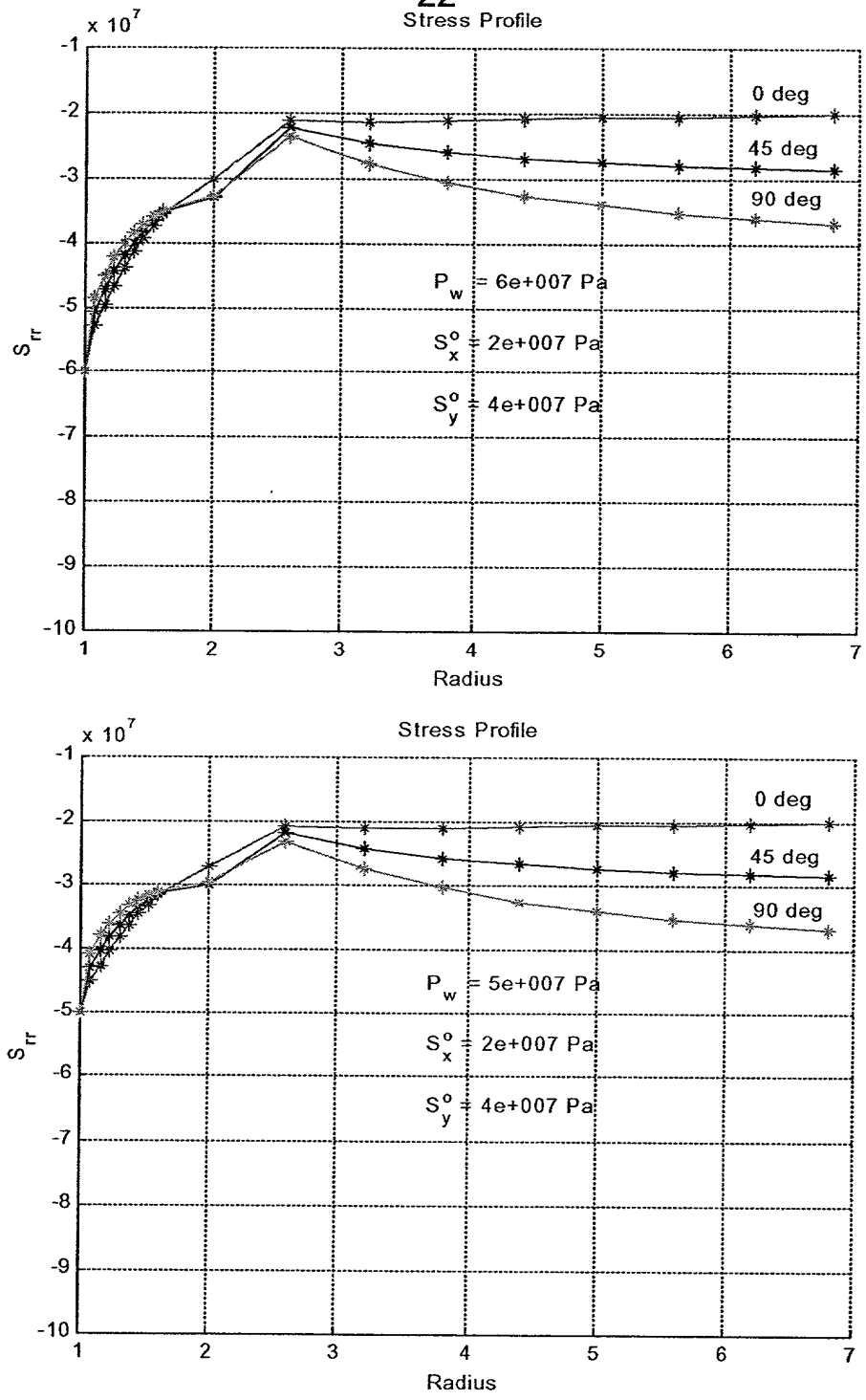


Fig. 23b Multiple zone model: Effect of internal pressure

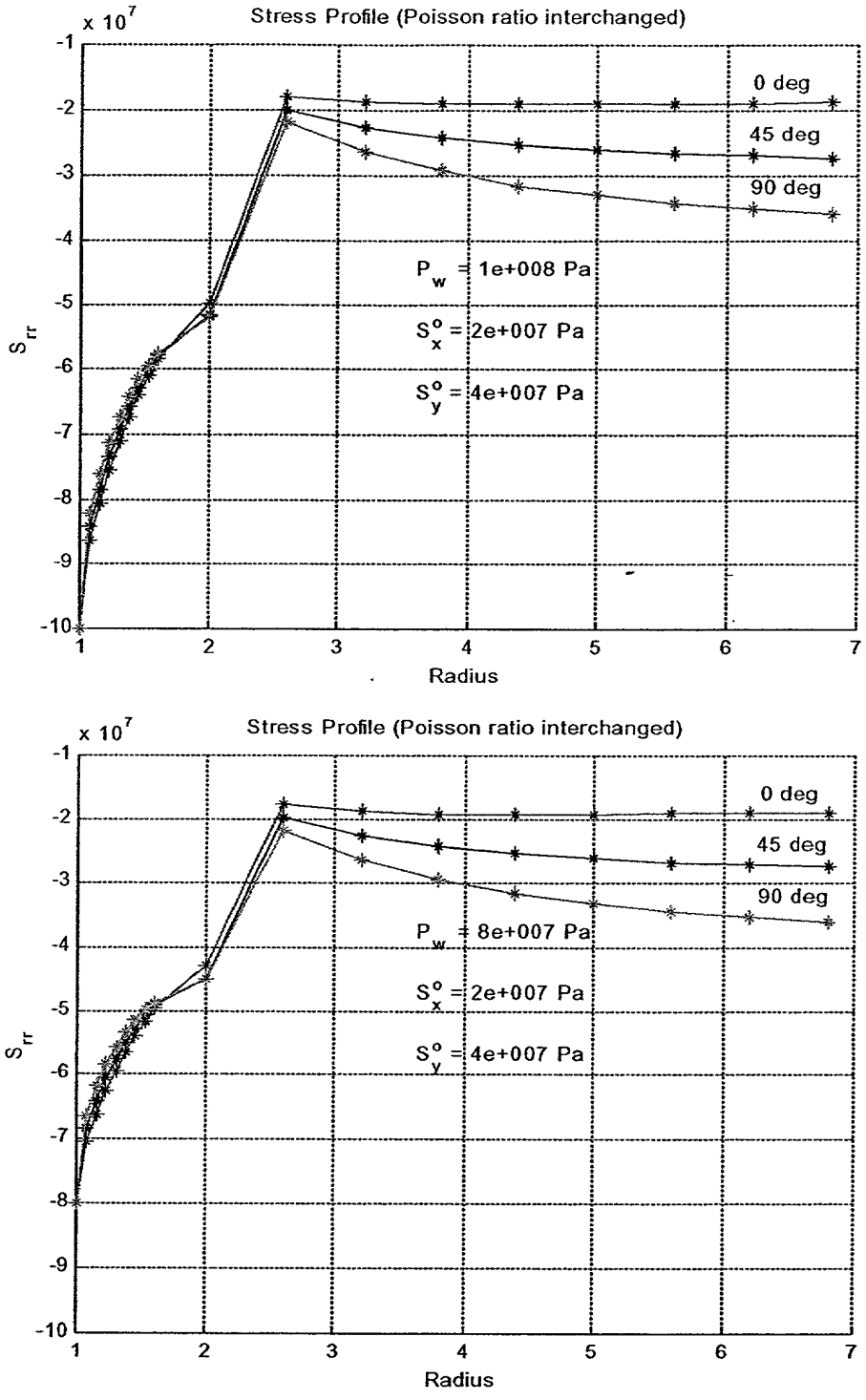


Fig. 24 Multiple zone model: Effect of Poisson ratio

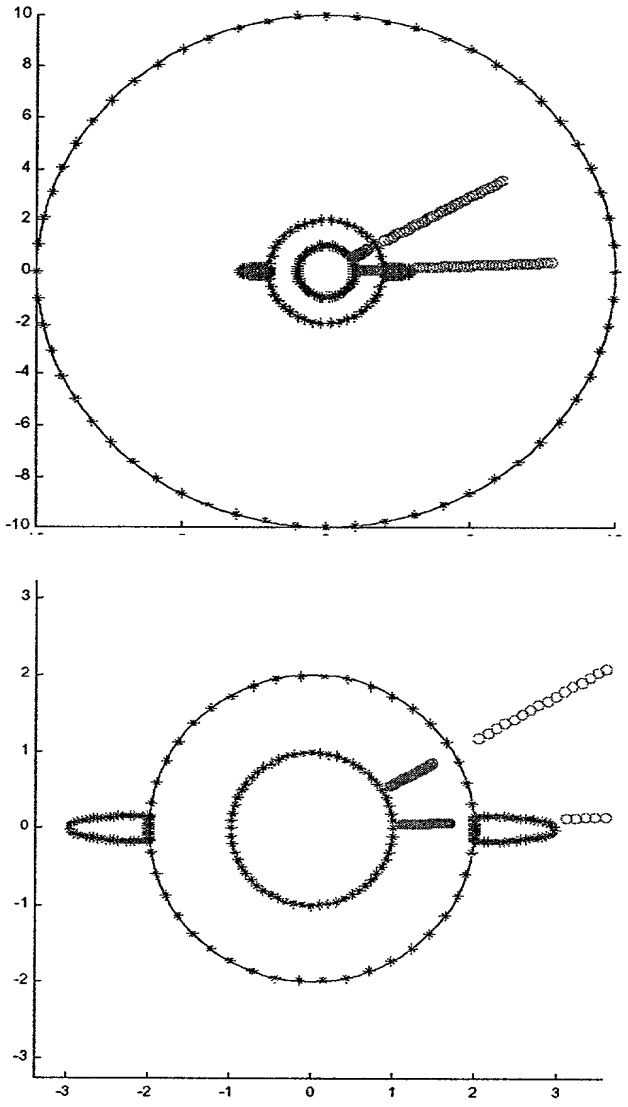


Fig. 25 Multiple zone model: Boundary elements with elliptical fracture

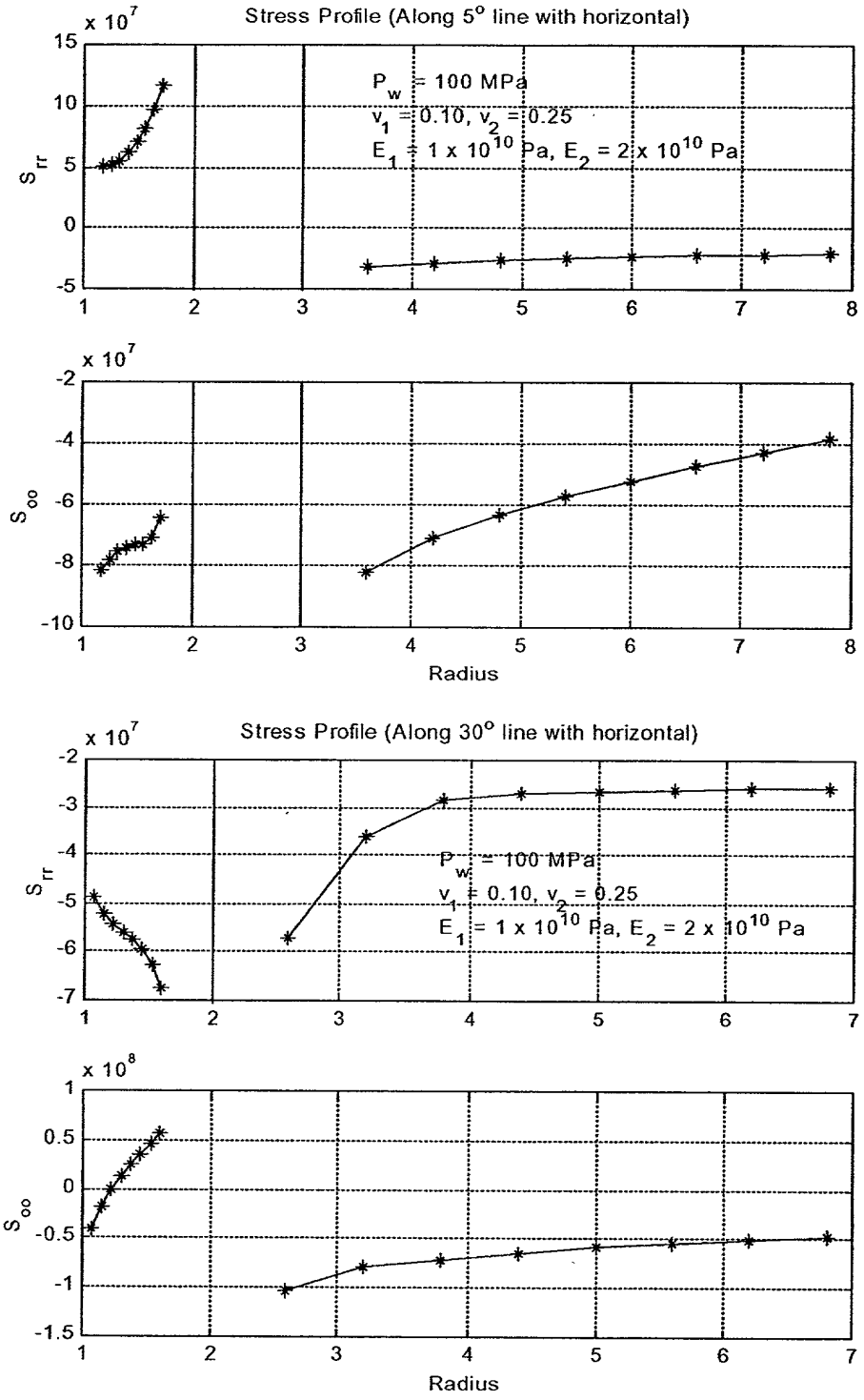


Fig. 26 Multiple zone model: Azimuthal variation

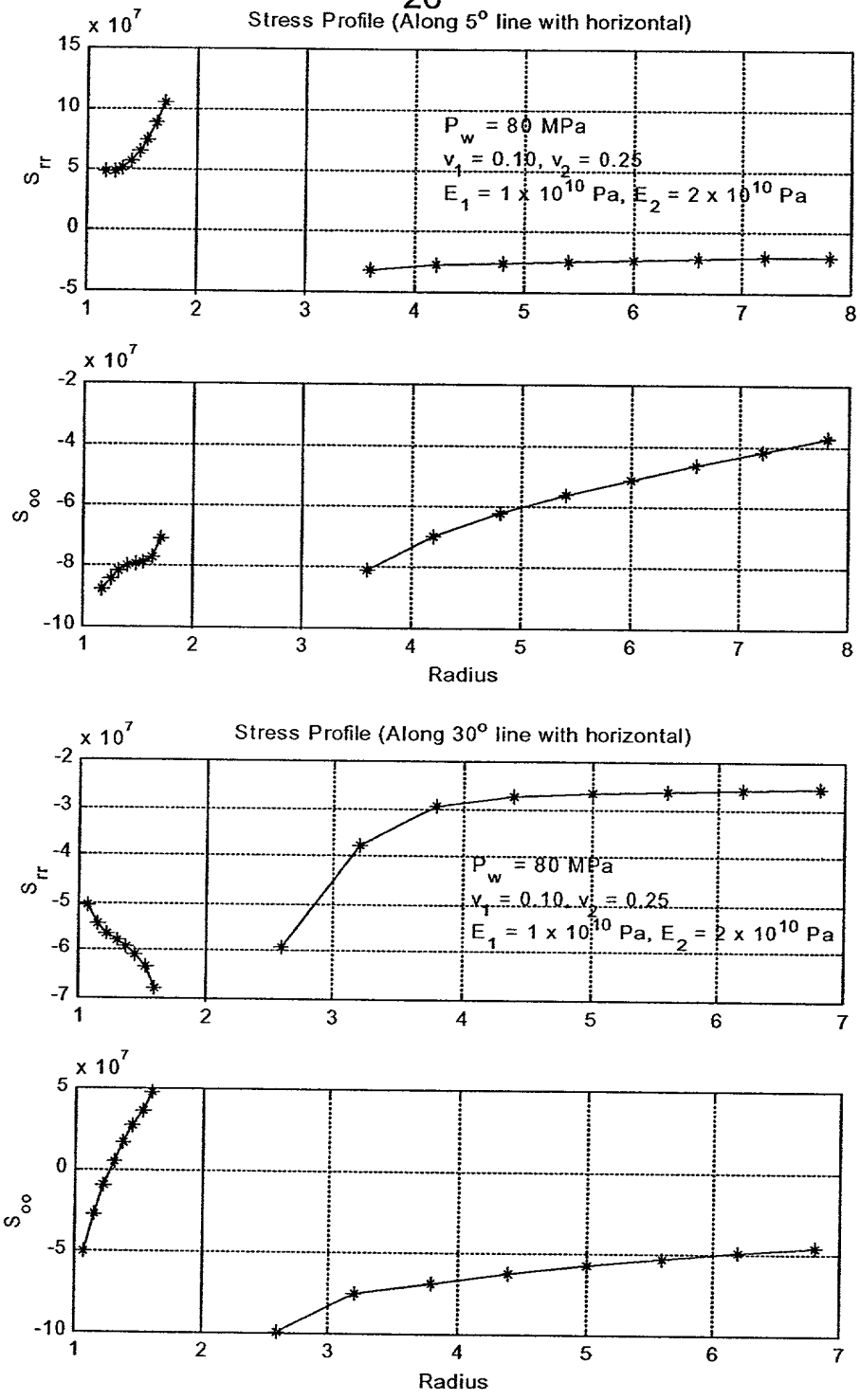


Fig. 27a Multiple zone model: Effect of fracturing pressure

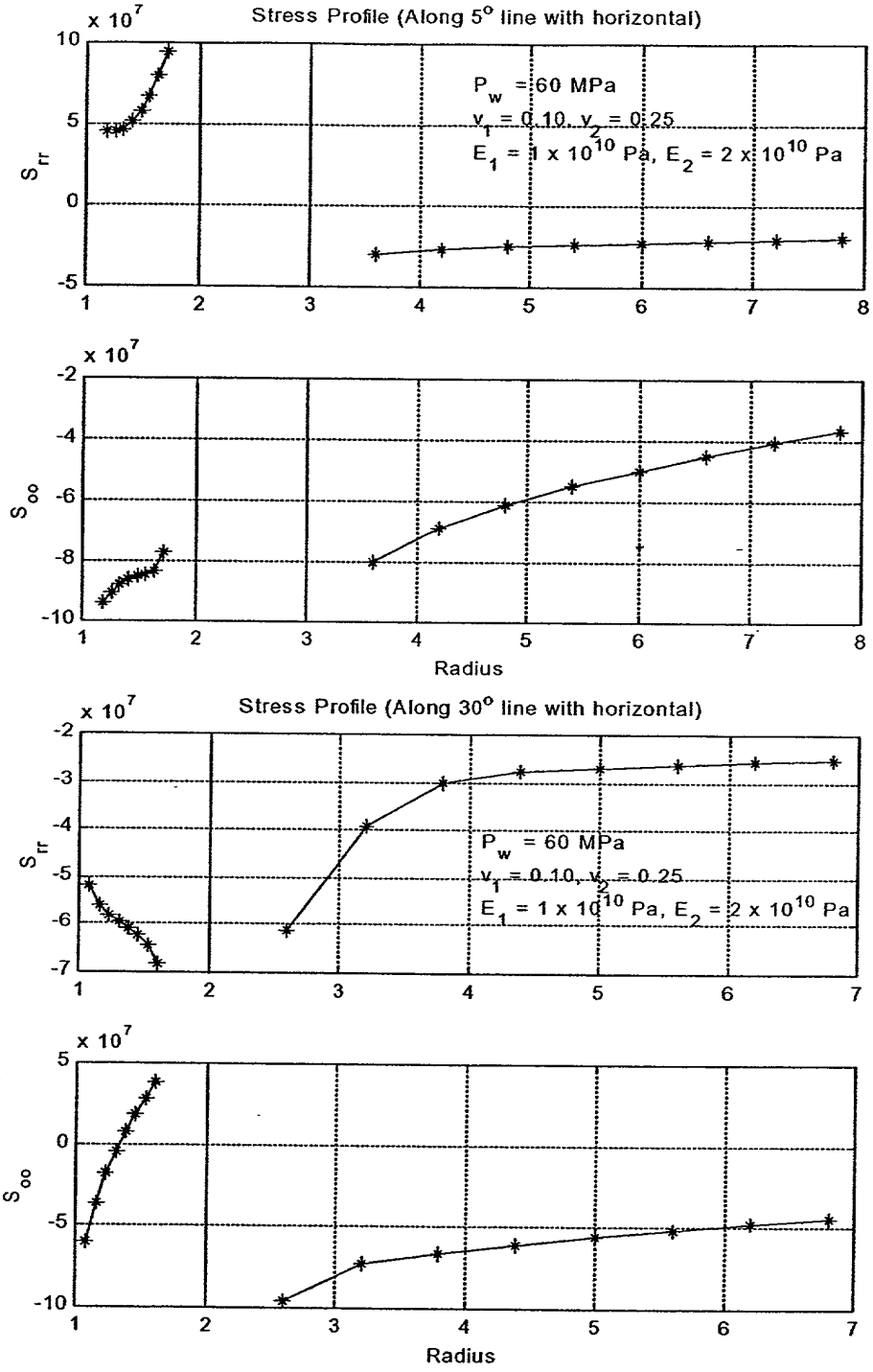


Fig. 27b Multiple zone model: Effect of fracturing pressure

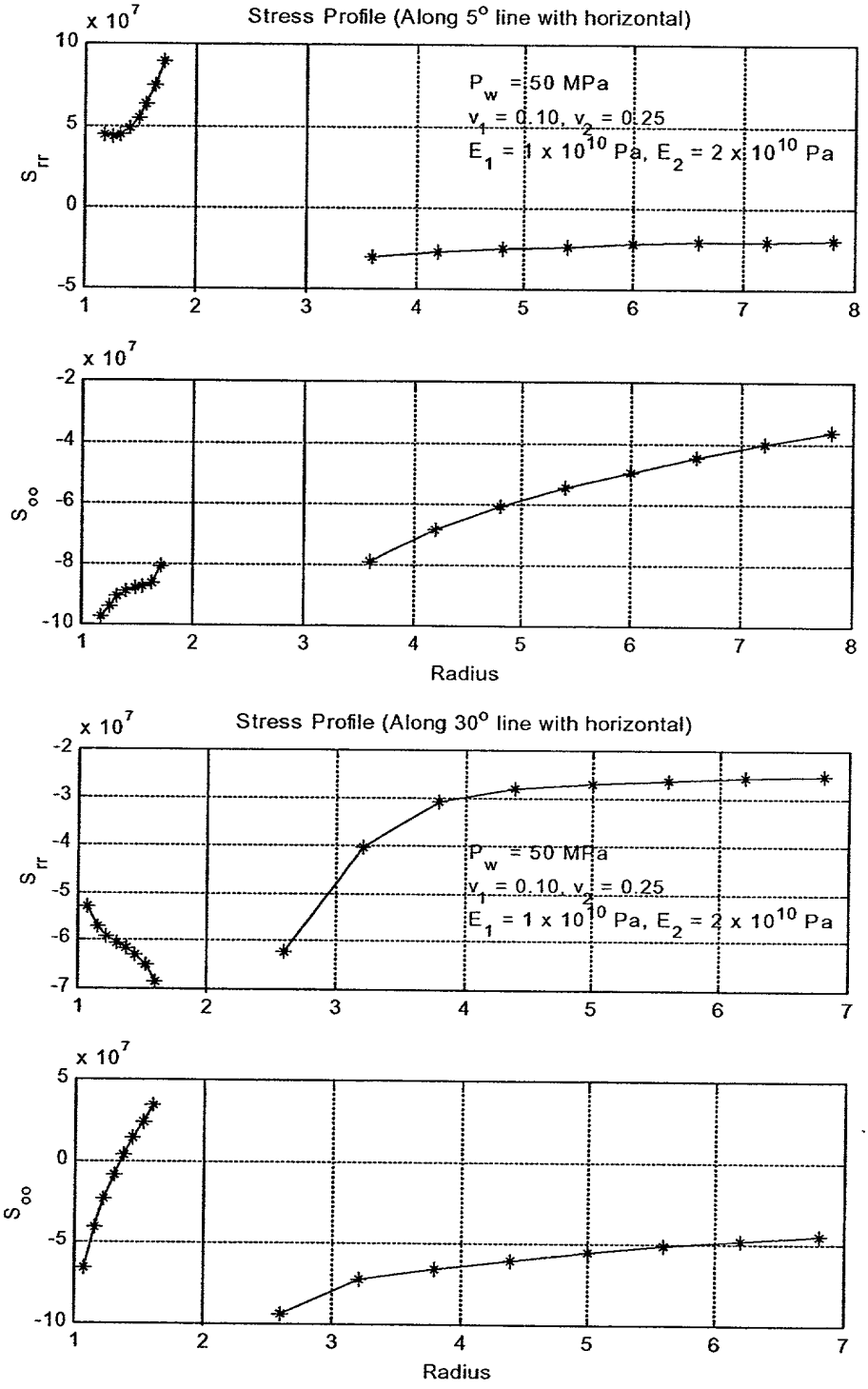


Fig. 27c Multiple zone model: Effect of fracturing pressure

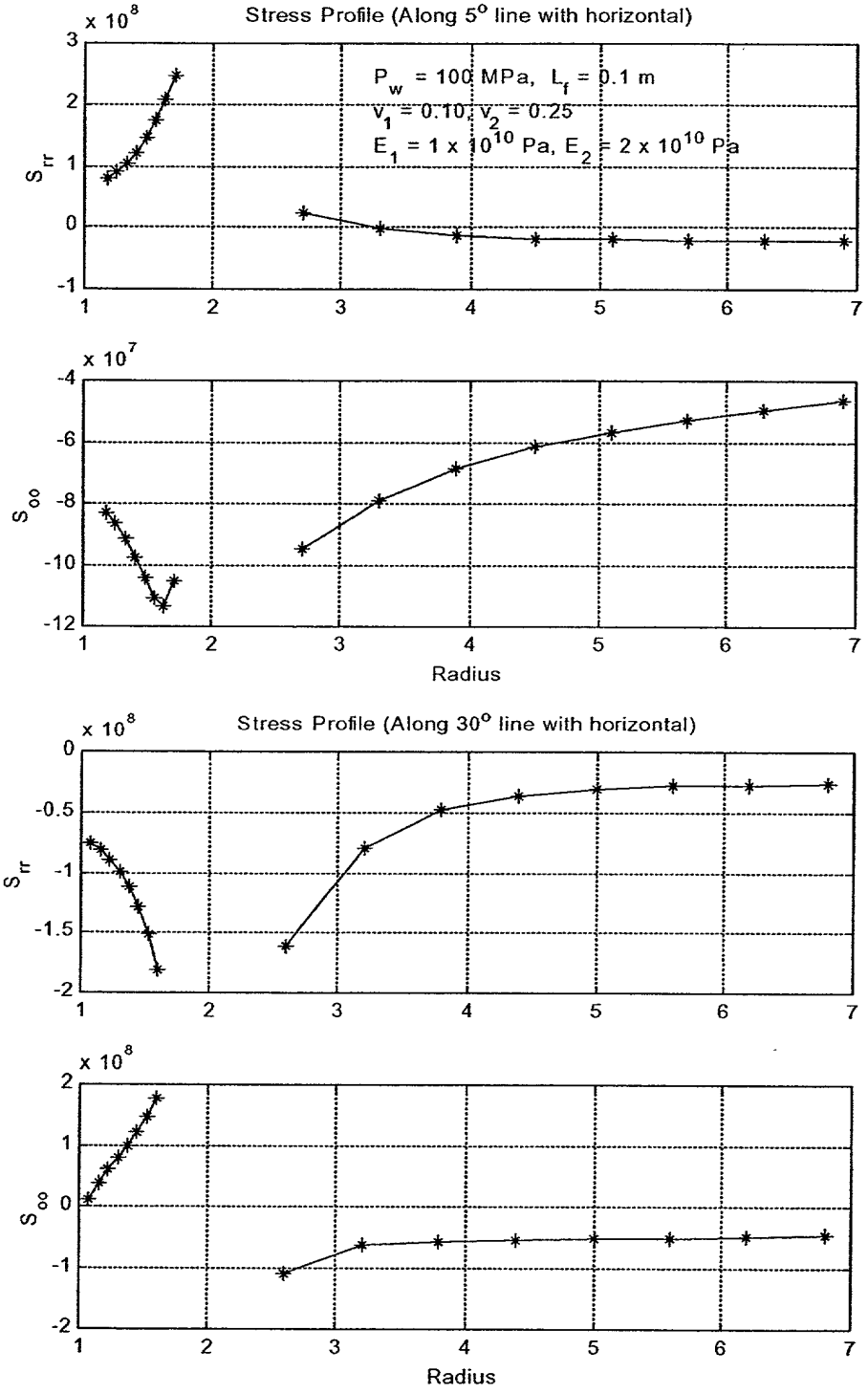


Fig. 28a Multiple zone model: Effect of fracture length

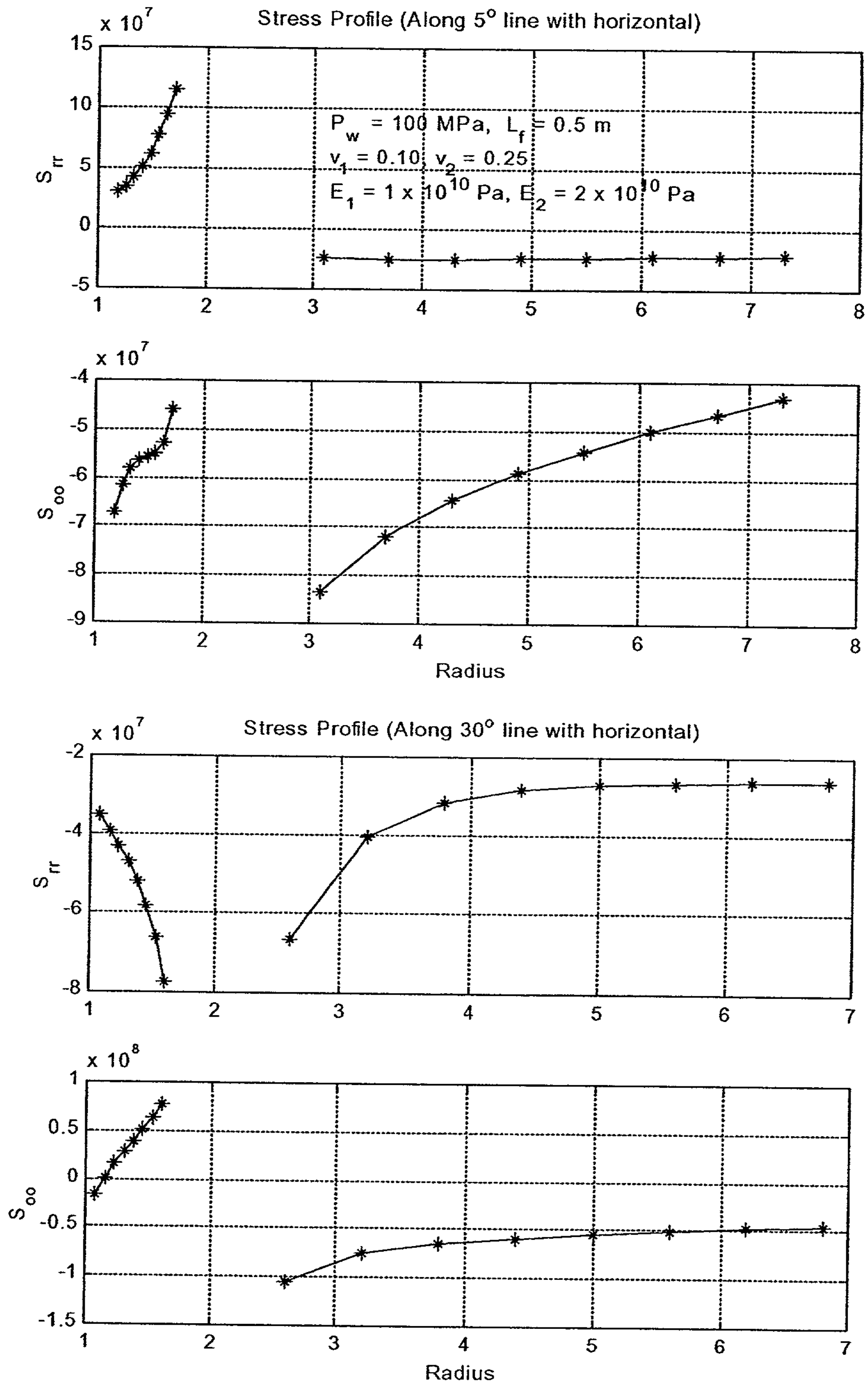


Fig. 28b Multiple zone model: Effect of fracture length

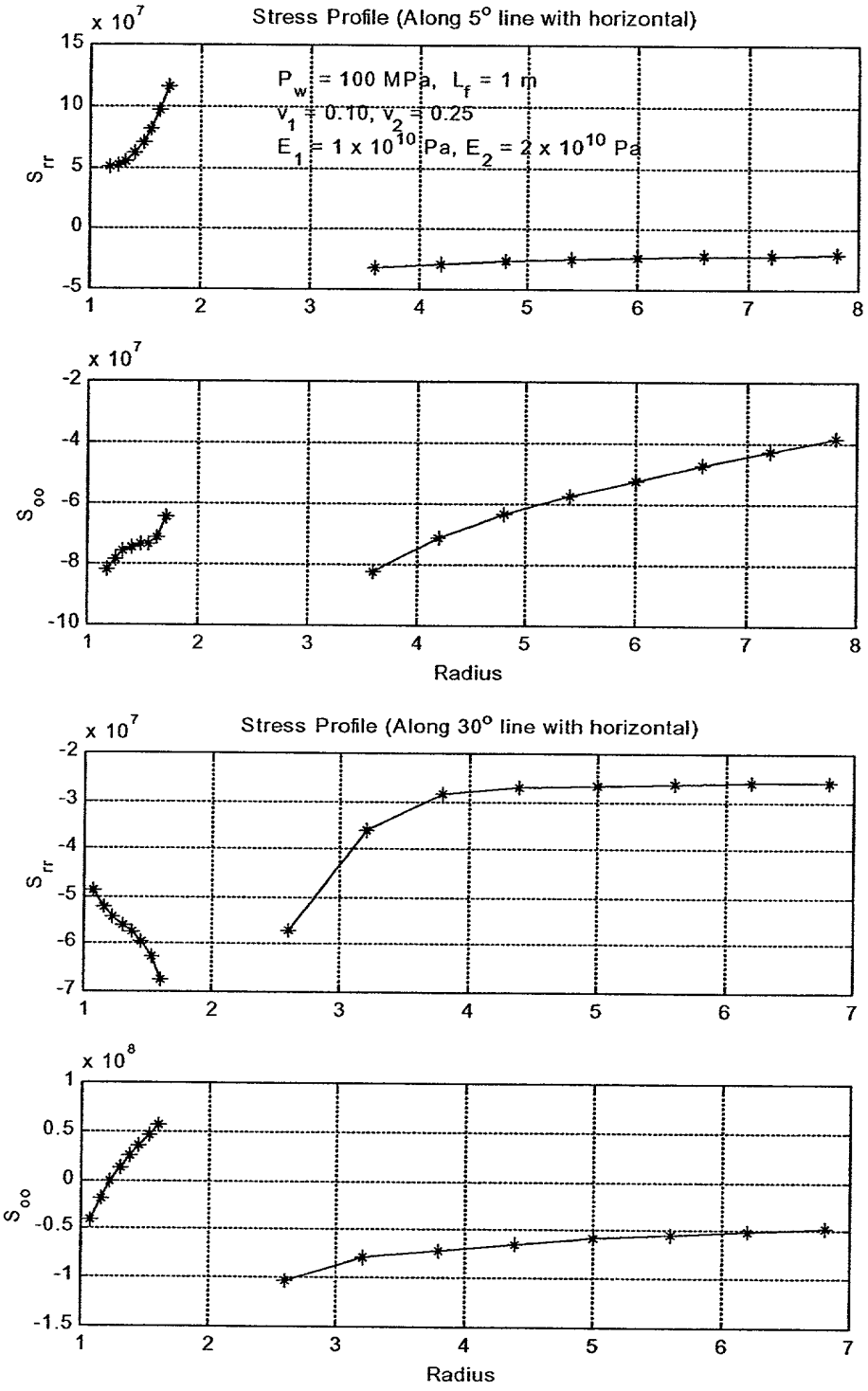


Fig. 28c Multiple zone model: Effect of fracture length

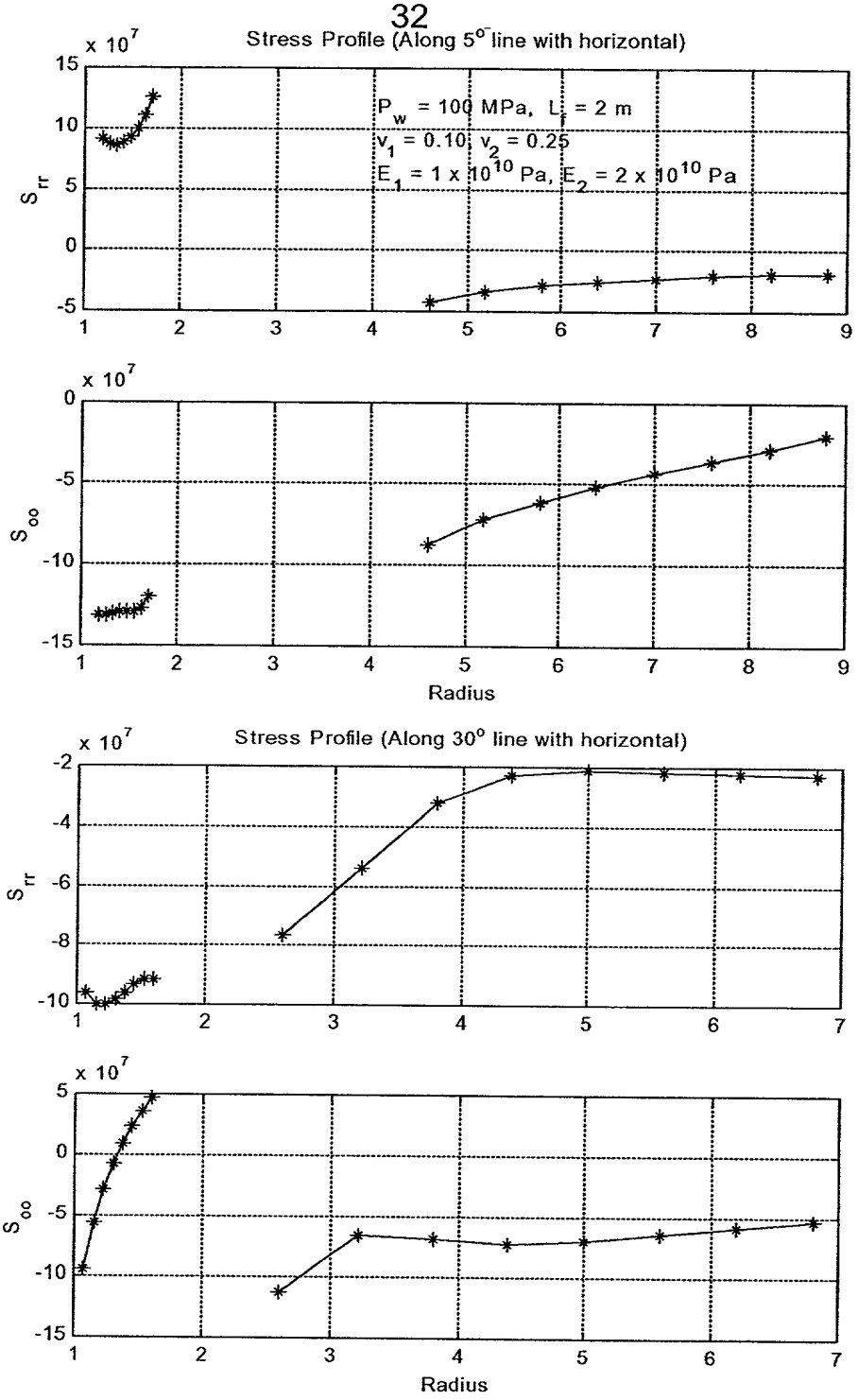


Fig. 28d Multiple zone model: Effect of fracture length

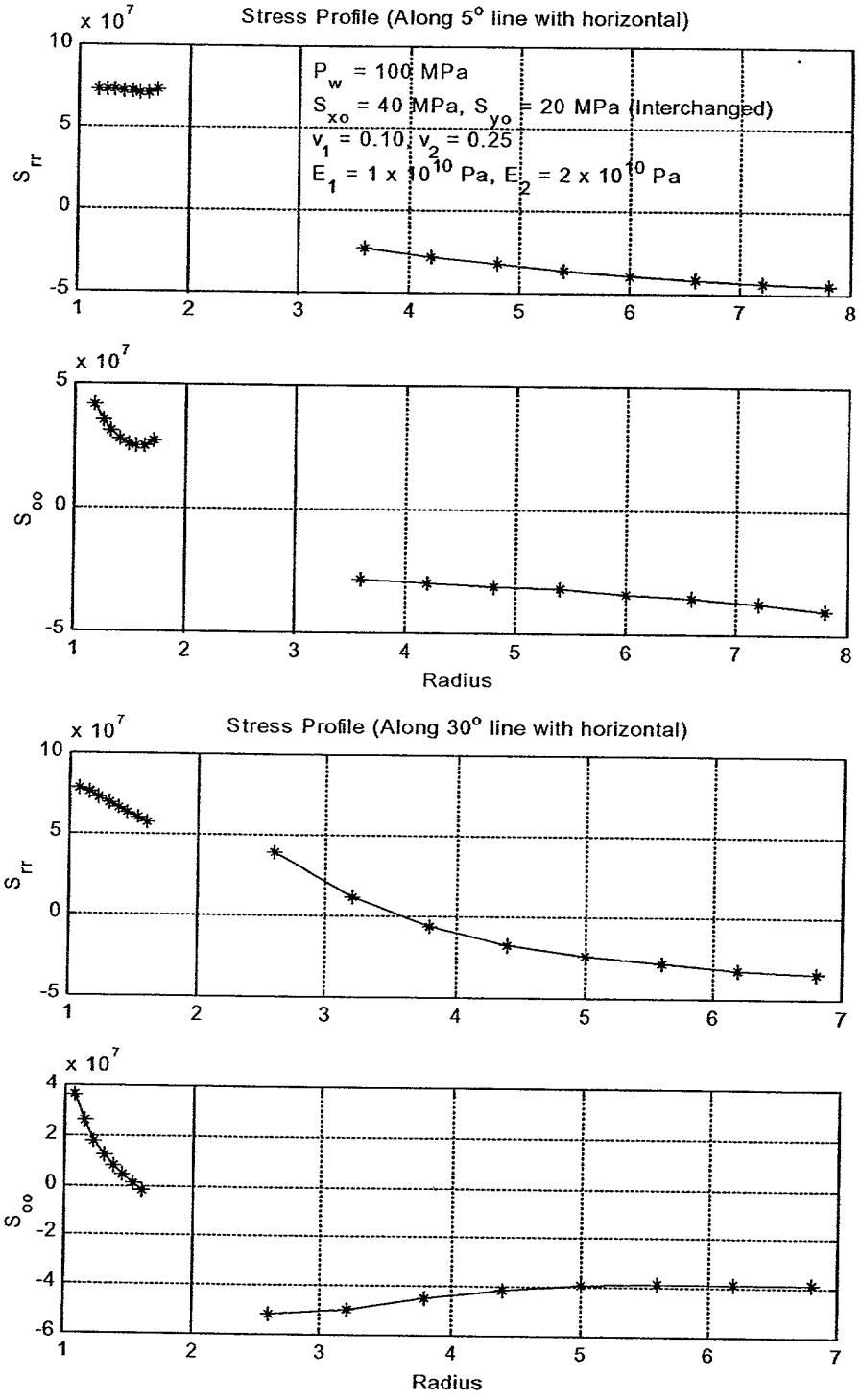


Fig. 29 Multiple zone model: Effect of far-field stress

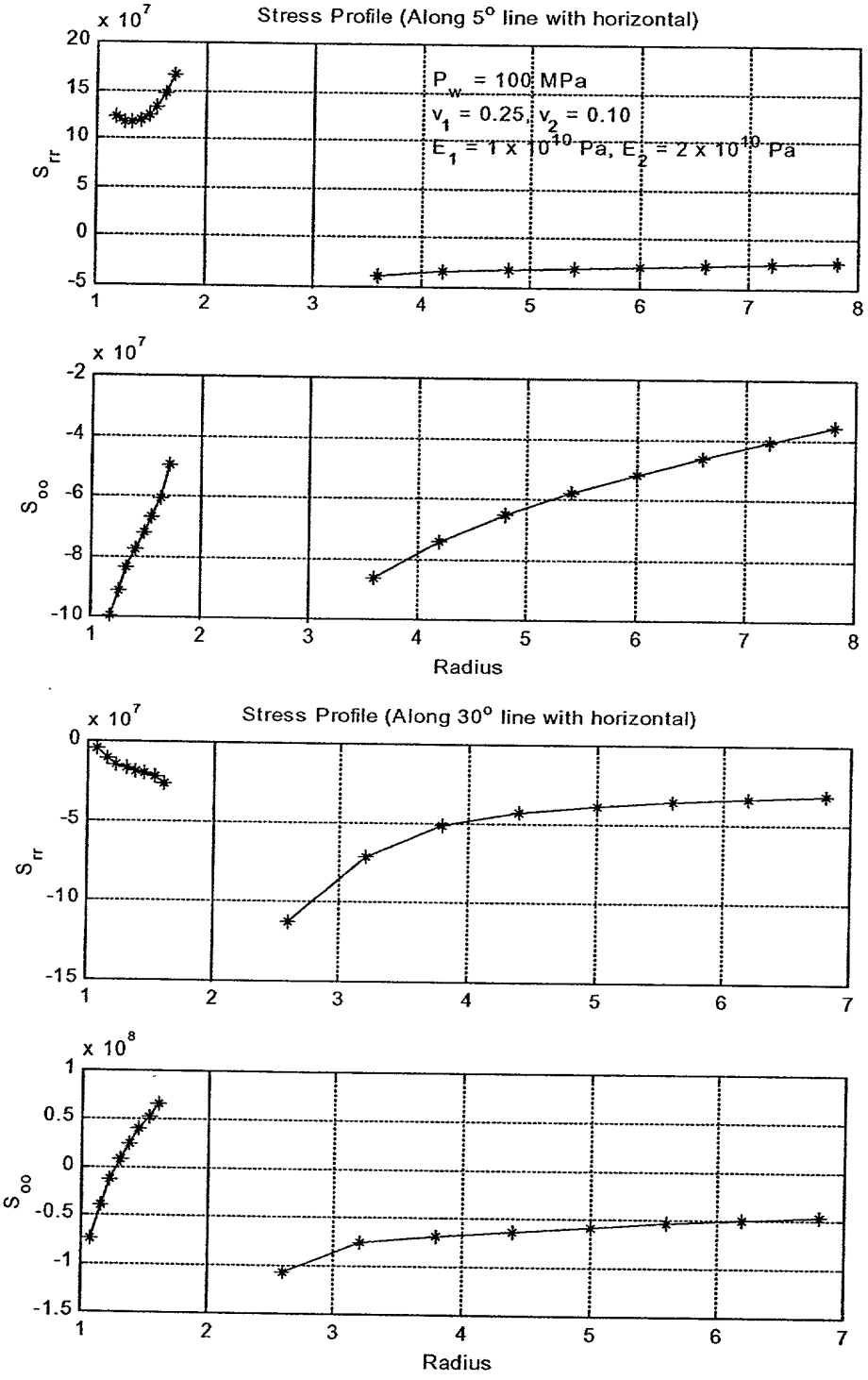


Fig. 30 Multiple zone model: Effect of poisson ratio

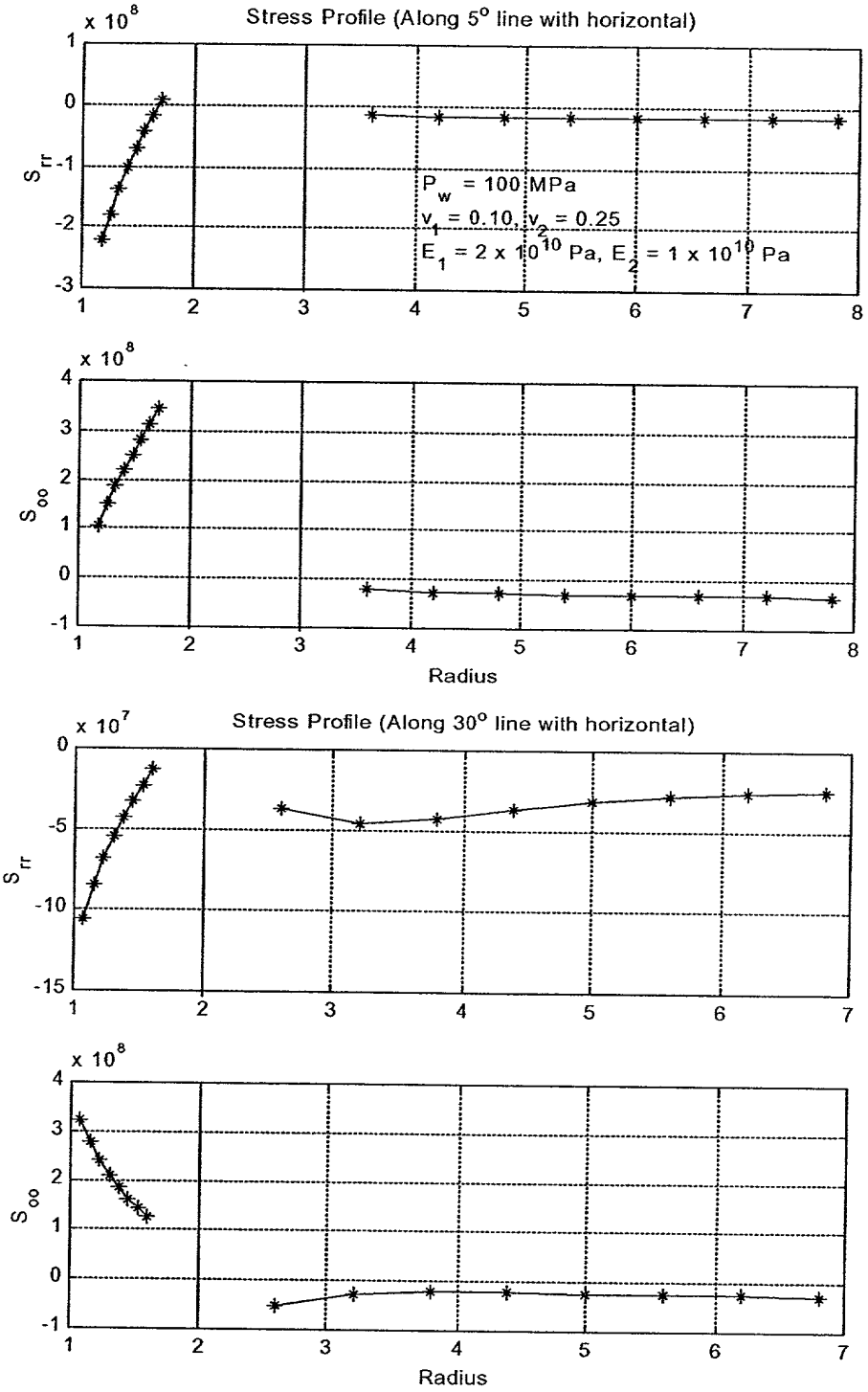


Fig. 31 Multiple zone model: Effect of Young's modulus